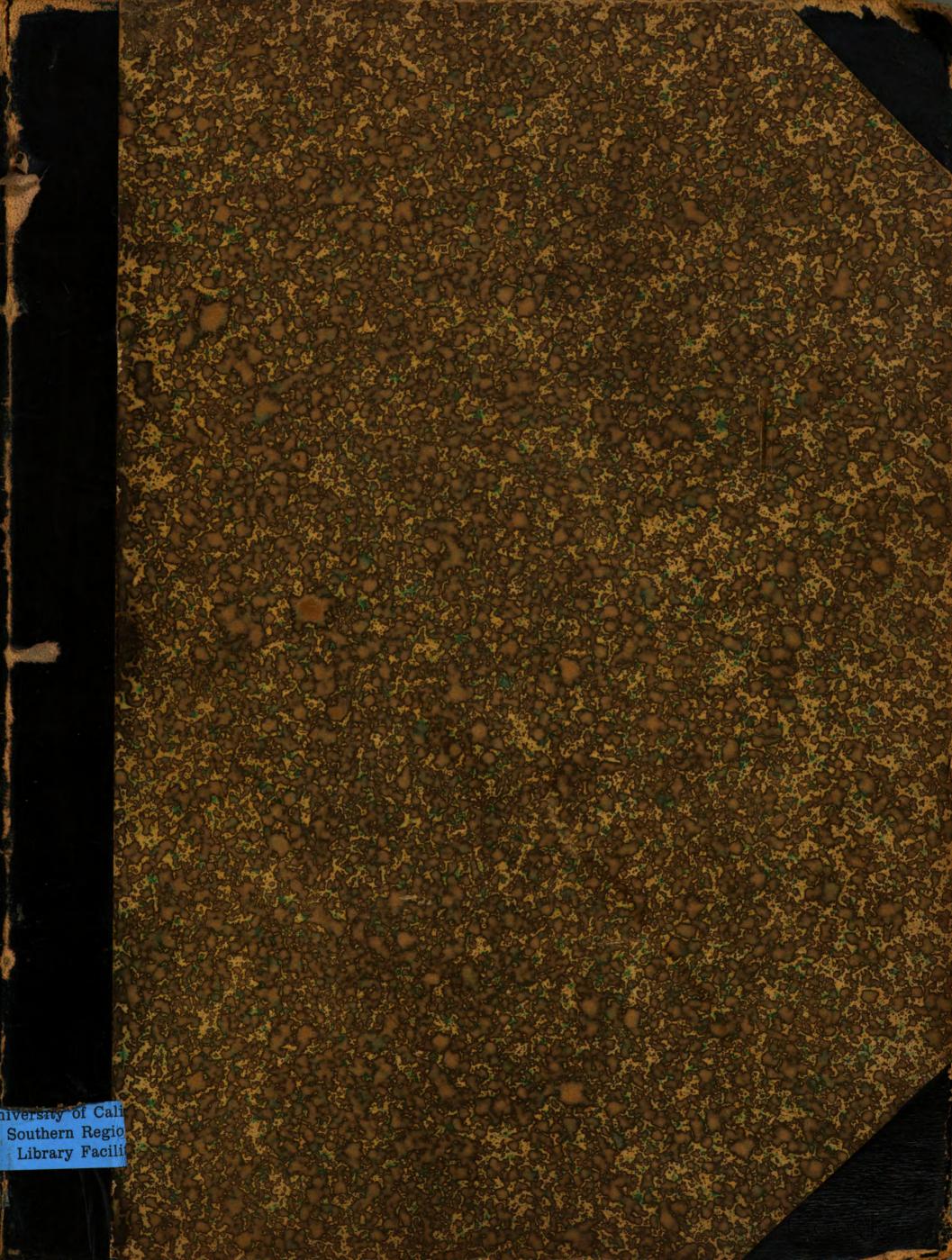
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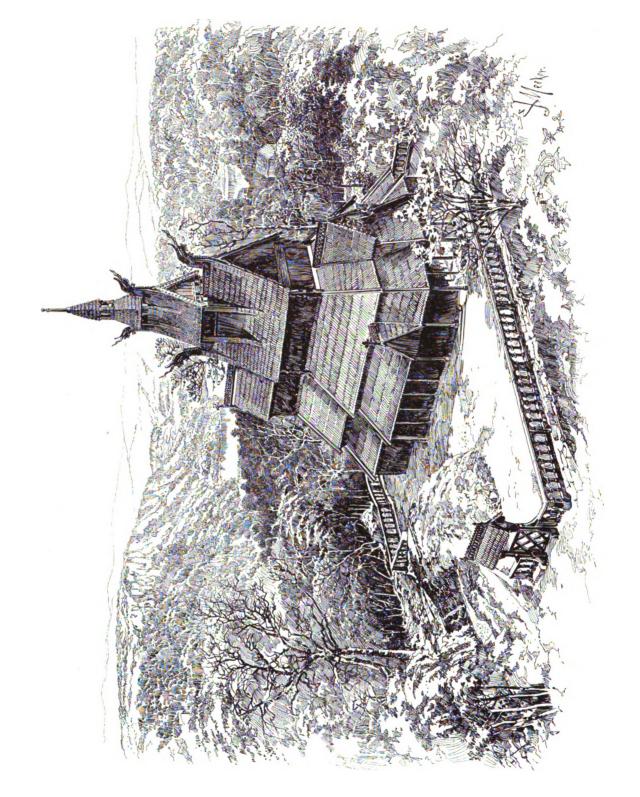


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Bridges, Roofs, Etc.	Engines—Boller.	Weston Engine Co xii	Builders' Iron Foundry Chattanooga Foundry & Pipe	Lancaster Steam Rad. Co xii Nason Mfg. Co xii	Chapman Valve Co iv Galvin Brass & Iron Works iv
Berlin Iron Bridge Co vi Columbia Iron and Steel Co vi	Best, John & Son x		Works v	, Rutzler & Blake x	Ludlow Valve Co
King Iron Bridge & Mfg. Co. vi Passaic Rolling Mill Co vi	Engines—Hoisting.	Metropole, London viii	Drummond, M. I	, Registers.	Vulcan Works x
Pencoyd Bridge and Const Co. vi	Kendall, Edward A. & Son vi Lidgerwood Mfg. Co	instruction—lechnical.	Emaus Pipe Foundry	Tuttle & Bailey Mfg. Co ix	Walworth Mfg. Co vi Ventilating Apparatus.
Phænix Bridge Co vi Pittsburg Bridge Co vi	Mundy, J. S vi Traud, Alexander vi	Inst. of Technology, Boston xvi School of Mines, Columbia	Lake Shore Foundry v	Regulators — Pressure-Reducing	Huyett & Smith Mfg. Co ix
Rochester Bridge & Iron Wks. vi Union Bridge Co vi		College, New York xvi	M. M1 D	Valve. Kieley, Timothy x	Sturtevant, B. F
Chica Bridge Co VI	Engraving—Photo. American Photo Engraving Co i	Stevens Inst., Hoboken, N. J. xvi	Mellert Foundry and Machine		Wanted viii Water and Gas Works Bullders.
Builders' Hardware.	Stevens & Morris ix	Iron-Work'— Structural and Orna mental.	New Philadelphia Pipe Works	Jackson, T. A vii	Riter & Conley vi
Newman, A. G. ii Ostrander, W. R. & Co ii Sullivan M	Filtere	Cheney & Hewlett vi	Pancoast & Rogers V South Pittsburg Pipe Works v	Rand Drill Co vi	Turner, Clarke & Rawson v
Sullivan, M i	Albany Steam Trap Co iv	Columbia Iron and Steel Co vi Composite Iron Works viii	Warren Foundry and Machine	Rubber Goods—Hose, Belting, Etc.	Water-Meters. National Meter Co viii
Ceiling-Paneled Iron.	National Water Purifying Co. iv	Cornell, J. B. & J. M viii Dimond, J. G. & T vi	Wells Rustless Iron Co	New York Belting & Packing Co vii	Shedd Water Meter Co viii Water-Waste Prevention Co viii
Northrop, Henry A ii	Ficor-Plates.	Hecla Bronze and Iron Works. Vi		Rustless Iron.	Water-Waste Prevention Co., VIII
_	Ahern, James 1x		Photographic Outfits.	Bower-Barff Rustless Iron Co. xiii	Pond Engineering Co v
Coment. Fisher, Erskine W iii	Function	Phœnix Iron Works vi	Loeber Bros vii	Sewer-Pipe—Drain and Culvert.	Wire Cloth.
Fleming, Howard iii	Abandroth Bros.	Lathes.	Plumbers.	American Sewer-Pipe Co vi	Clinton Wire-Cloth Co New Jersey Wire-Cloth Co it
Meacham & Wright		Lodge, Davis & Co x	Daricte, Oliver	Anderson Bros vii Blackmer & Post vii	Wood Stains.
New York and Rosendale	Food Products. Liebig Coii	Machinery Supplies.	Boyd, Harkness xii Corboy, M. Jxv	i Calumet Fire-Clay Co vii	Berry Bros i
Cement Co iii Norton, F. O iii	Thurber, Whyland & Co i		Hindley, Thomas & Son xv	Evens & Howard vii	Dexter Brosi Cabot, Samueli
Chemist.	Euspiehing Coods Costs'	Marbie.	Hughes & Stephenson xv. Hussey, Henry & Co xv	Francy's, John Sons & Co vii	Wood-Work—Interior, Cabinet, Etc
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^{*}When page is not given Advertisement is not in this issue.

The Engineering and Building Record

THE SANITARY ENGINEER.

ESTABLISHED 1877.

Conducted by HENRY C. MEYER.

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"A paper whose excellence and independence merit continued prosperity."—Railroad and Engineering Journal.
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Machinist.

Under date of January 9, 1888, General M. C. Meigs, formerly Quartermaster-General, U. S. Army, and recently Architect of the new Pension Building at Washington, wrote as follows:

1239 VERMONT AVENUE, WASHINGTON, D. C., January 9, 1888.

THE ENGINE RING AND BUILDING RECORD:

DEAR SIRS: I enclose check for \$5.00, for which please send me "Steam Heating Problems" and "Plumbing and House-Drainage Problems." I will be obliged, also, for a copy of your No. 6, Volume XVII., January 7, 1888, which is a capital number, just read and sent to a Western engineer, a friend, containing much in his line of work.

I have looked at the Index of Volume XVI. It is a marvelous list of knowledge made accessible to the profession at small cost to each subscriber.

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THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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WITH this issue this journal begins its seventeenth volume.

GOVERNMENT BUILDING METHODS.

AT the recent annual convention of the American Institute of Architects, Mr. M. E. Bell, the late Supervising Architect of the United States Government, read a paper on "The Paramount Requirements of a National Building for Custom-House, Judicial, and Postal Purposes." His four years' experience in the Government service should secure for his suggestions careful consideration, and we reprint his paper on another page of this issue. He clearly points out one cause for the needless expense and unsatisfactory results in the erection of our Government buildings in saying that when the erection of a building is authorized only a small portion of the sum needed is appropriated. Contracts cannot, therefore, be entered into beyond amounts appropriated, hence it is plain to see how an architect is hampered, the work delayed, and the ultimate cost largely increased. Mr. Bell is doubtless correct when he says:

"The lower House of Congress being Democratic and the Senate Republican, each is trying to make a record for economy in appropriations; and while it is possible to pass bills for necessary buildings, the appropriation committees decline to appropriate the money and must assume the responsibility for everything resulting from a policy of inadequate and dribbling appropriations."

And further very truly adds:

"The public are much more interested in this matter than the architects themselves;" and "Ignorance of the subject is our enemy to fight."

The public-spirited members of the architectural profession have been doing good service in recent years in their agitation looking to an improvement in our Government architecture and building methods. Yet we apprehend that much popular education on this point will still be necessary to stimulate Congress to deal with the question as it deserves. Such education should, therefore, be the constant work of our architectural associations, and then, when the country is fortunate enough to have in Congress one influential member who appreciates the importance of the reform that is needed and is willing to devote his time and energies to secure the necessary legislation, then, and not till then, can our architects secure that for which they are so commendably striving. Earnest effort, therefore, should be made to find such a man and enlist him in the cause, since without such an advocate the recommendations of occasional committees will be of little avail.

DO THE INHABITANTS OF NEWARK AND OF JERSEY CITY SOMETIMES DRINK SEWAGE?

THE answer to the above question must now be, clearly and definitely, yes. "But," says an ancient citizen of Newark, "suppose we do, what of it? The water looks good and tastes good. I've been drinking the water ever since it was introduced and I'm all right." No doubt many of the people of Newark would say the same thing. Many of them are protected against the disease which affords the most striking evidence of the impurity of a water-supply-viz., typhoid fever—because they have been affected with this disease years ago, and, as a rule—just as is the case with regard to scarlet fever—a man has the disease but once.

According to a paper by Dr. A. R. Leeds, published in the May number of the Journal of the American Chemical Society, the pollution of the Jersey City supply is somewhat greater than that of Newark, and it has an effect on the deathrate, as is shown by comparison with the deathrate of Hoboken, which last city has had a purer water-supply since 1882.

This matter of the pollution of the Passaic River has been several times discussed in this journal during the last eight years. There is no doubt that a sufficient supply of pure water can be obtained for all the cities which now depend on the impure waters of this stream. We have also no doubt that if the present system of supply to these cities be continued the result will be disastrous to their commercial prosperity, because of the reputation for unhealthfulness which they will soon obtain, if they have not already done so; but it will probably require a positive demonstration of this in the shape of the loss of a number of lives and marked depreciation in the value of property before anything will be done in earnest to remedy the evil.

If a few cholera cases occur in Paterson or Passaic and the discharges from them gain access to the river the evidence furnished by the results will probably be quite sufficient to convince even the most conservative citizens of Newark and Jersey City not only that they are drinking dilute sewage, but that it is, in the long run, a very unhealthy and expensive beverage. In awakening a popular interest in this problem, the recent articles in the New York Sun have been very timely.

THE ILLINOIS RIVER IMPROVEMENT CONVENTION.

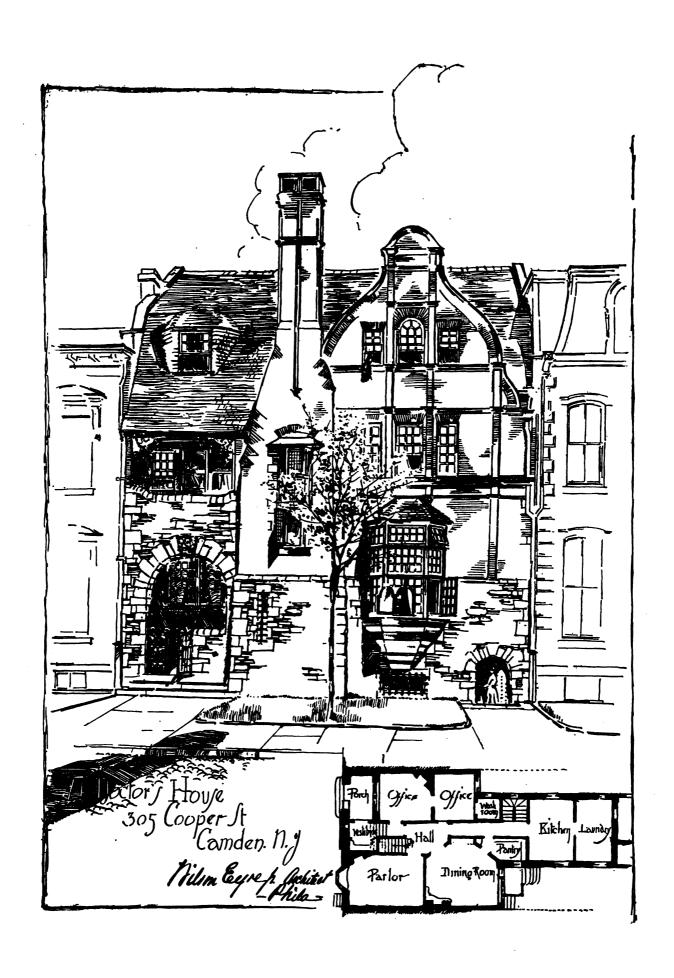
This body met at Peoria, Ill., and, as a result of its deliberations, passed a series of resolutions announcing the conviction of its members of both the necessity and wisdom of the improvement by the general Government of the natural waterways of the country, and the construction of canals in locations where they partake at all of a national character.

The rivers specifically named are the Desplaines, Illinois, and Mississippi, and the canal particularly mentioned is the Hennepin. The grounds for advocating these schemes are not only commercial, but they are claimed to be necessary as means of national defence.

In a former issue we printed the substance of a report by a Board of United States Engineers, composed of Generals C. B. Comstock and O. M. Poe, and Major J. C. Post, on the Hennepin Canal, which fully endorses the desirability of its construction.

THE ENGINEERING AND BUILDING RECORD fully believes in the policy of a very wide extension of the routes for inland navigation, not only as a check upon railroad charges, but for the reason that in many cases they furnish the readiest built and cheapest communication to small and remote communities. It cannot be that the policy so universally recognized and acted upon in Europe is a mistaken one, and in this respect we may draw a lesson from the Old World.





TRANSACTIONS OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.*

MR. WILLIAM H. CROSSLAND'S paper on the Royal Holloway College gives an account of the ideal manner in which Mr. Holloway, his client, allowed him to construct this building.

The early French Renaissance was the style chosen by the architect and accepted by Mr. Holloway. Before Mr. Crossland started the design of the building his client required him to spend two or three months sketching and measuring the chateaux of the Loire. All the principal chateaux were studied and complete drawings of Chambord were made by the architect and his assistants. Two years for the study of the design were allowed the architect, and not until all the detail drawings were completed was the work begun. In accordance with the excellent English practice the contract was based upon quantities of material furnished by a quantity surveyor, and Mr. Holloway paid the salary of a clerk of the works, whose duties were strictly confined to the superintendence of the construction. The architect had a bungalow built and went into residence on the spot.

The stone-cutting was done at the site. The sculptor who modeled all the decorative details had his studio at the building. Five years were spent in the construction of the building, and from the beginning until the end the client was on the works but four times. As his result, Mr. Crossland has produced a well-planned and well-massed building, with much interesting detail in the manner of the style he adopted. But, judging from the published views, he has not given the *spirit* of the period he chose to copy to the work as a whole.

The paper by Mr. John Phillips, C. E., treats upon the "Drainage of the Palace and City of Westminster," which has been illustrated and described in these columns.

Mr. T. G. Jackson gives an extremely interesting paper upon the "Architecture of Dalmatia." Except through a slight sketch by Professor Freeman, Dalmatia has been known to architects only through Diocletian's palace at Spalato.

Mr. Jackson shows that there are many monuments unique and interesting both to the architect and the archæologist. From him we learn that much beautiful and highly perfected Romanesque arch and some very original Kenaissance buildings are to be seen there, and, what is of most curious interest, that the Romanesque was practically the prevailing style in all important buildings from the day Diocletian's palace was built until the adoption of the Renaissance style.

The latest Romanesque arch in Dalmatia dates from 1400-1409. At that time the French were building in the Flamboyant style, the English in the Perpendicular. Ghiberti had won the competition for the Gates of the Baptistery at Florence. Brunnellechi had gone to Rome to study the remains of classical art, to return to build the dome of the Duomo; the Renaissance was about to be.

Thus the ancient round-arched work of Dalmatia almost meets the new round-arched work of the Classical Revival.

Under the rule of Venice, the Venetian Gothic was introduced mainly in domestic work. In one great church only, the Duomo of Sebenico, is used the Gothic style, and of this church only the lower parts of the nave and the aisles are Gothic, the rest being finished by a Renaissance architect. The Gothic part was built between 1430 and 1441. The Renaissance style was no sooner established in Dalmatia than it displaced the Gothic style for all buildings of importance.

Savs Mr. Jackson:

"The Dalmatian Renaissance work is eclectic from first to last; pointed arches and trefoil cusps are found combined with fluted pilasters and shell-headed niches, and classic entablatures surmount arcades that might have been constructed in the fourteenth century. However strangely mixed the elements of the designs may be, they are happily combined with a true artistic instinct, and, taken together, they produce a consistent and harmonious whole, which owes perhaps not a little of the effect it produces to the piquant assemblage in unexpected agreement of elements that might have been expected to disagree.

"The Renaissance art in Dalmatia continued, as it had begun, free from the shackles of a rigid formalism. It never developed, as it did in Italy, into pure Palladianism, till, in the latter part of the seventeenth century, it suddenly sunk into the slough of the 'Barocco,' in which all its life and beauty was at once smothered, and architecture as a fine art ceased to exist."

*Vol. III. New Series.

Through all its different phases architecture in Dalmatia was inspired by the forms used in Diocletian's palace, and there seems to be no doubt that the existence of this great monument as a model was the one main cause of the constancy with which this people clung to the Romanesque style till the end of the fcurteenth century, and of the promptness with which they rejected the pointed arch when the Renaissance brought the round arch into use again.

Mr. Jackson's paper is extremely interesting, and points out a mass of rich and suggestive material for the study of our architects, who are nothing if not eclectic, and so should be the gainers by the study of the unconscious eclecticism of these old builders.

We are glad to see that Mr. Jackson has published lately a large work upon Dalmatian architecture.

THE NICARAGUA CANAL EXPEDITION.

THE following is the personnel of this expedition which sailed November 30 on the steamer "Hondo," expecting to arrive at Greytown in about ten days, stopping on the way at Jamaica and Fortune Island to pick up some 100 laborers to act as axemen, porters, etc.:

Lieutenant R. E. Peary, U. S. N., Sub-Chief Engineer of the Nicaragua Canal Construction Company, commands the expedition. Chiefs of parties are: J. Francis Le Baron, Domingo G. Cartaya, Frank P. Davis, J. W. Pethard, Garnett Savage, William J. Maxwell, J. F. Perez.

Assistant Engineers.—W. V. Alford, J. G. Holcomb, F. T. Bernhardt, H. C. Miller, P. H. Bevier, McDonough Craven, Ricardo Molino, H. C. Litchfield, Culixto Guiteras, A. J. Menocal, E. M. Hunt, J. T. Ford, F. W. Bennett.

Rodmen.—P. B. Cooke, Enrique Cole, Emil Diebitsch, Paul Spicer, William McCawley, P. R. Van Wyck, Jr., Perry Fuller.

Chainmen.—Louis William Mohun, G. B. Stratton, John M. Murphy, R. J. Wilson, Daniel B. Macauley, Harry W. Johnson.

Surgeon.—William Nicholson, M. D. Cierks.—J. Crowninshield, Charles E. Kern. Draughtsmen.—A. A. Aquirre, H. D. Murphy. Leadsman.—Iohn Kirk.

New York Herald Correspondent .- W. N. King, Jr.

These gentlemen are under contract with the Construction Company for nine months, by which time it is presumed the surveys will be completed. One hundred and twenty-five thousand dollars has been provided to defray the expense.

Notes of the survey will be forwarded to New York as fast as taken where the location will be determined: y the Chief Engineer, Mr. A. G. Menocal, Civil Engineer, U. S. N., and then staked out accordingly on the ground at Nicaragua.

The proposed route extends from Greytown, on the Caribbean Sea, to Brito, on the Pacific. Its total length is 169.8 miles. The Lake of Nicaragua, 110 feet above the mean level of the sea, will be the summit level, and the rivers flowing into and from the lake will be utilized to the best advantage, in order to reduce the actual canal excavation to the least possible limit. A system of locks on either side of the lake will be constructed, of such dimensions as to give commodious passage to vessels of the size now used for ocean navigation in Europe and America. The bottom width of the forty miles of canal will vary from 80 to 120 feet, and the surface width from 80 to 288 feet, with a depth of from 28 to 30 feet, but the 129 miles of river and lake will form a waterway safe for rapid navigation with ample depth throughout. The total cost is estimated at \$64.036,197, and the time required at six years.

THE Commercial and Industrial Museum at Antwerp has just been opened.

An exhibition of apparatus for preventing accidents in breweries and other works is to be held in Berlin in 1889.

OUR SPECIAL ILLUSTRATION.

CHATEAU D'ECOUEEN, MAYENE, FRANCE.

A DOCTOR'S HOUSE, CAMDEN, N. J.—WILSON EYRE, JR., ARCHITECT,

THE NEW DRY-DOCKS AT HAVRE.

WE translate the following from the Genie Civil of October 29, believing that, with the dry-dock just completed at the San Francisco Navy Yard, those being built at Norfolk and Newport News, and the one for which ground is just being broken at the New York Navy Yard, it will be found of timely interest, especially as "Dock No. 5" is believed to be larger than any in this country, except the Newport News one and that at Red Hook, Brooklyn, which are 600 and 610 feet long, respectively. We propose to describe one or more of these docks in later issues. The designs for the Havre docks were prepared by M. Maurice Widmer, Engineer in Ordinary of Bridges and Roads, under the direction of M. Quinette de Rochemont, Engineer in Chief. The work was executed under their direction and that of Superintendent Delorme by Messrs. Hallier and Letellier, assisted by Messrs. Biehler and Reignard. Figures 1 and 2, which we have had redrawn, are a general section and plan of the work, while Figs. 3 and 4 are photographic reproductions. Figure 3 is a view looking west and shows the condition of the work on the 30th of November, 1886, when the excavation was nearly completed, and Fig. 4 is a view looking east, taken June 30, 1887, while the concrete bottom was being put in.

The docking facilities of the port of Havre consist of four dry-docks built by the Government, one careening platform, one floating dock, and three careening pontoons. Three of the docks are located in the basin of the citadel, the longest being only 70 metres. The floating dock in the Barre basin is 65 metres long, and can only be used for vessels not exceeding 1,500 tons. Only the fourth dock, or No. 4, built in 1864, and 130 metres long on the keel blocks, can receive the large vessels of the Compagnie Transatlantique. The vessels recently built by this company, such as the "Champagne," 155 metres long, can only be received in this dock by removing some of the stone-work at one end. The constant increase in the size of the vessels frequenting the port of Havre has made it necessary to construct larger docks, and it is this work now being done on the two new docks, Nos. 5 and 6, that is here described.

This work was placed in the hands of Messrs. Adrien Hallier and Eugene Letellier, contractors for public works, and is briefly summed as follows:

First-Dock No. 5 and part of its entrance.

Second-Dock No. 6 and its entrance.

Third—A sump to receive the drainage from the two new docks.

Fourth—Conduits connecting the docks with the above sump and the present sump.

Fifth—The streets, working platforms, etc., around the docks.

Sixth—The removal of the stone coffer-dam at the head of the entrance of Dock 5, and that part of the wall east of the Eure basin, and between the entrance walls of Dock No. 6.

The following table gives the principal dimensions:

Name.	Dock No. 5.	Dock No. 6.	Remarks.
Entrances.	Metres.	Metres.	w the mean
Total length	25.80	25.80 16.00	B 4
Width at bottom	17.96	14.18	<u> </u>
Elevation at coping	9.15	9.15	m. belc below
Elevation at bottom	-0.85	c.00	ئے ہے
Elevation at the foundation Depth of water on the bottom at low		-4.15	8 🖆
water	7 00	6.15	15.0
Depth of water on the bottom at high water	8.70	7.85	. <u>s.</u> ∞
	1,.	,	and
Docks.	1		
Length on coping	163.72	126.72	g g .
Length on the keel blocks	150.00	115.00	of r l sur ater
Width at coping	27.44	23.44	plane of referi natural surface high water.
walls	18.00	14.18	plane natura high
Elevation at bottom of foundations.	-5.10	-4.25	lq na 1 hig
Elevation at bottom of rudder-pit	-9.60	-8.75	The plane natural high w
Thickness of the bed at the centre.	3.15	3.15	F
	•	, 1	

Each dock includes the floor, the entrance, two parallel side walls united at the side opposite the entrance by a semi-circle, large offsets with material slides, four flights of stairs, two entrance conduits, two conduits to connect the dock with the sump, and, lastly, the sump itself.

The concrete bottom with its brick facing has a thickness of 3^m·15 at the centre of each dock. Each dock has a rudder-pit, which is drained by connecting with the conduits under the side walls. Large cranes will be set on the south embankment of Dock 5, and on the north embank



ment of Dock 6. The two inlet conduits of each dock are cylindrical, opening at the Eure Basin end below the water, and at the other end below the bed of the dock.

The Eure docks are emptied by means of pumps, but the present apparatus is not sufficient to drain Nos. 4, 5, and 6. Proposals have been invited for an apparatus capable of draining Dock 4 in three hours.

The rudder-pits in the two new docks are to facilitate the unshipping and shipping of the rudders of vessels for repairs, etc.

GENERAL CONDITIONS OF THE ENTERPRISE.

Two problems had to be solved by the contractors. One consisted in the extreme difficulty, under the conditions existing, of finding room for the plant. On the west was the Eure Basin; the use of the ground between Docks 4 and 6 was forbidden in the specifications. There remained therefore only part of the ground between Dock 5 and the Tancarville Canal, the width of which was 22m. at one end and 15m. at the other end. On the remaining side there was only a space 7m wide. The clear space north of Dock 4 had been set aside for a temporary dumping-ground for excavated material. The contractors therefore had only a passage 7m. wide at their disposal for the tram-road, and this could not be extended more than 100m., or it would have interfered with a swingbridge over the Tancarville Canal. As a result all excavated matter had to be taken out on the south side, and on this single space 7m. wide.

The experience of the enormous drainage and filtration encountered when the Bellot Basin was excavated lent additional interest to this work, and, contrary to its usual custom, the Government had included the drainage in the contracts with the excavation, and this constituted the other difficulty on account of the large filtration likely to be met with, not only on account of the proximity of the Eure Basin, Dock No. 4, and the canal, but because a bed of gravel and sand, easily permeated by water, had to be encountered, which had formerly in other work given great trouble. A drainage system was early inaugurated by the contractors, which alone made it possible to lay the beds of the docks. Work was begun on the north side of the docks, and the drainage systems were so arranged from the start that all waters, surface and otherwise, were drained toward a given point, from whence they could be pumped out. This was also necessary, on account of the small space at the disposal of the contractors for the moving of excavated matter. Work was then started on the south

The ground consisted of a sandy clay, interspersed with beds of peat, until the gravel, already alluded to, was reached, on which the foundations of the docks were laid. This ground stays firm and dry on a slope of 45°, and could be spaded out, but the Government deemed it prudent, to prevent any possibility of the ground's sliding, to cover the slopes with basket-work mattresses, which it did at its own expense.

After a general excavation over the whole surface of 1mby hand, an excavator was set to work on the south side. This machine dug a trench 30m wide and 5m.50 deep, or 25,000 cubic metres. The north side was excavated by the aid of dump-cars drawn by a 15-ton locomotive and filled by hand. Each car held 2 cubic metres of earth. On this side 26,000 cubic metres were taken out. The two excavations were pushed from opposite directions transversely until there only remained a bank 12m wide between them. (See Fig. 3.) This bank was then gradually taken away, with the help of large wagons, until there only remained enough on which a track could be laid to run cars for further excavation. Finally even this ridge was removed, the earth being run out on the inclined planes, which had then been built.

From this time on the contractors organized two provisional systems to get rid of the now very abundant water—namely, by means of ditches and pumping apparatus.

At this point ends what may be called the first period of construction. There now remained to be executed the excavation of the part left between the top of the embankment of Dock 6 and the ditch made by the excavator, also the deepening of the trench at the sides to —5^m·10 for Dock 5 and to —4^m·25 for Dock 6. Then the laying of the beton beds, and the final arrangement of the drainage.

The order of the work was not followed as above recounted, because it was possible to carry on much of it simultaneously.

The first work was executed by hand with the help of large wagons, but presently, as depth was gained, the

wagons were replaced by an inclined plane of om.13 to the metre, which permitted of all further excavation except a ridge for tramway.

The rest of the excavations were done by hand by Hallier's system of cars on inclined planes. These inclines were established on the south side of the work, the inclines being 1^m·75 base to 1^m· height, with a gauge of 0^m·40. There were six inclines, working in groups of two, each running three cars. Each plane had two tracks, serving alternately for loaded and empty cars. A locomotive drew a train of eighteen cars from the excavating

transmission shaft, run by two stationary engines, one for each group of three inclines. This did not prove satisfactory, however, and an eight-horse-power hoisting-engine was placed at the head of each incline. The boilers were vertical and had twenty-four square metres of heating surface, one boiler furnishing steam for two engines. It required eight horse-power to operate each incline, except for incline No. 7, which required twelve horse-power. The amount carried on the inclines from January 4 to July 31, 1887, was 95,000 cubic metres.

In this manner the work was pushed until the terracing

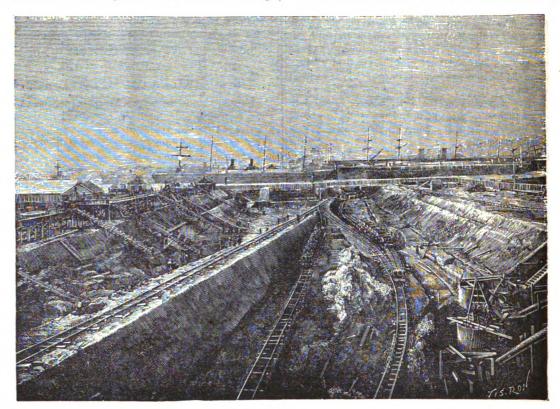


FIGURE 3.

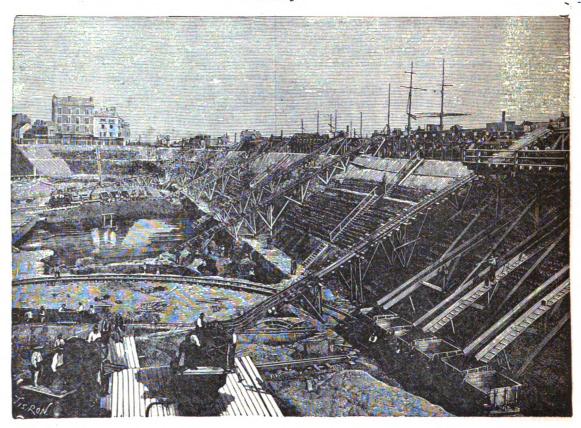


FIGURE 4.

point to the inclines, leaving six at each group of two, then drew away the empty ones in the same manner.

A seventh inclined plane, more strongly constructed than the others, for special heavy service, was located in the south-east angle of the excavation. The reason for having this incline in this location was to push the excavations on that side rapidly. The cars in this case are pushed into a cul-de-sac in sections of six and then run out together.

An attempt was made to use some old machinery for operating the six first-described inclines by means of a of Dock 5 was complete and part of No. 6. At the same time the rudder pit of No. 5 was being excavated.

The laying of the bed of No. 5 was accomplished during the further excavations in No. 6. Then, in order to avoid any break in the work, and to prevent any filtration, the laying of the concrete was begun at the eastern end and carried on without intermission, covering the entire bed of the dock. The mortar used was composed of 500 kilogrammes Portland cement to a cubic metre of sand. The concrete was made up of three parts broken stone to



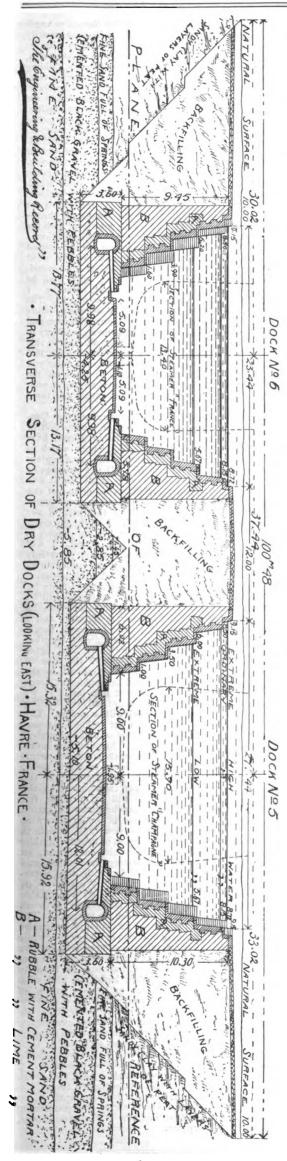


Fig. 1

two parts mortar. The contractors were greatly impeded in their concrete-making by want of space, and most of this work had to be done down in the south-west angle of the excavation.

The concreting plant consisted of six mortar-mixers, each two being run by a fifteen-horse-power engine. The six machines produced 150 cubic metres per day of eleven hours, and supplied, by means of special cars and track, three concrete-mixers; these latter produced 360 cubic metres of concrete per day.

The concrete-mixers discharged through shoots o m-80 wide into cars, each of which held two cubic metres. These were run on a track laid on a ridge that had been kept at the bottom of the dock on the south side. The concrete trains each consisted of six cars, a loaded train running out and an empty one back, propelled by 7-ton locomotives, on a track of one metre gauge. As the dock-bed was concreted the track was removed.

It took 33 days and 11,000 cubic metres of material to concrete the bed of No. 5 Dock. During this time the inclines were in operation, only interrupted long enough

relief-pumps, was of 50 horse-power. They were originally condensing engines, but it became necessary, on account of the constant work, to remodel them so that they could be worked either as condensing or as high pressure.

The pumps discharged 25,000 cubic metres per hour, the engines running at 120 revolutions. The water was pumped into a reservoir, and from thence by a subterranean conduit was discharged into the Tancarville Canal.

The sump to receive the drainage of the docks was a special work. Its close proximity to the Government's plant for emptying Dock No. 4 made it necessary, for prudential reasons, to use a special caisson on that side, which was first worked openly, but finally with compressed air.

On the 1st of last September the bed of Dock 5 was complete, and nearly all of the bed of Dock 6. The rudder-pit of No. 5 was finished, and that of No. 6 in process of excavation by compressed air. There then remained to finish the entire work, the excavation for the side walls of No. 6, the removal of the Eure coffer-dam, the clearing away of the old side walls and masonry, and the completion of the emptying conduits which the contractors

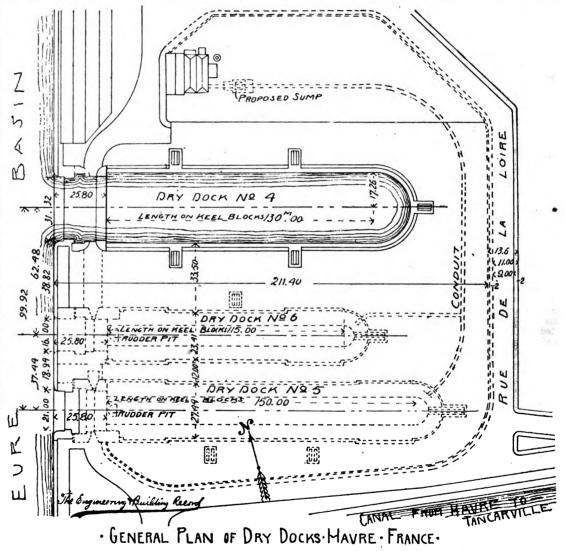


FIGURE 2.

when one was reached by the concrete gang to raise the lower end to concrete beneath it, and then replace the same.

The last portion of the work was the building of the main sump. The specifications required that the contractors should keep the infiltrating waters drained down to $-7^{\text{m.io}}$, or $2^{\text{m.io}}$ below the bottom of the excavations. The main sump is circular and is sunk to a depth of $-10^{\text{m.io}}$. It has a sheathing of plate-iron $0^{\text{m.io}}$ below the bottom of the excavations. The main sump is circular and is sunk to a depth of $-10^{\text{m.io}}$. It has a sheathing of plate-iron $0^{\text{m.io}}$ blick and $1^{\text{m.io}}$ high. The main drain between the two docks was so arranged as not to interfere with the rest of the work, and drained into the main sump. It also carried off the waste water from the four pumping systems; each system consisting of two connecting-pumps.

The pumps were furnished by the Messrs. Dumont. Six were of the type No. 10, and the other pumps, only to be used as reliefs, were of the type No. 8. The discharge-pipes of the first were om-30 diameter; the two other were om-25 diameter. The engines, placed on concrete foundations some distance back from the excavations, were furnished by Messrs. Weyher & Richmond. Three were of 70 horse-power, and the fourth, designed for running the

expect to accomplish in a braced open cut, except at the junction of the two sumps, which would have to be done with compressed air."

Messrs. Hallier & Letellier are highly complimented by the writer of the article in the *Genie Civil* for the excellent manner in which they have surmounted the difficulties in their way and have quickly accomplished their work in spite of limited space and infiltering waters.

PARAMOUNT REQUIREMENTS OF A NA.
TIONAL BUILDING FOR CUSTOM-HOUSE,
JUDICIAL AND POSTAL PURPOSES.*

BY M. E. BELL.

(Late Supervising Architect, U. S. Treasury Department.)

Mr. President and Professional Brethren:—The Secretary of our Institute has selected as the subject of this paper the "Paramount Requirement of a National Building for Custom-House, Judicial and Postal Purposes." The obligation was suggested to me, no doubt, because of my late incumbency of the office of Supervising Architect of the Government at Washington, and because nearly four years of my life has been devoted wholly to the work of that office, which, at this time, has upwards

*A paper read at Convention of American Institute of Architects, Chicago, October, 1887.

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6

of eighty such buildings under its management and in course of construction. By referring to my subject in detail, I find that I am requested to treat of "paramount requirements" as regards site, construction, disposition of space, arrangements of water-supply, day and night illumination, ingress and exit, heating, ventilation, hygiene generally, and provision against conflagration, as well as any other points involved in this special theme which my studies and experience have led me to class as important. I confess at the start that I hesitated long and seri-ously before accepting such an obligation, because I think when all the subjects mentioned are thoroughly digested, including those that I might class as important, there is very little left to discuss from the practical standpoint of our profession; and when the obligation is coupled with the request, oft repeated, that the paper shall be a short one, the obligation seems all the more difficult.

I have accepted it, however, not that I have hopes of presenting anything novel or entertaining to this convention, so many members of which are twice my own age in the practice of our profession, but with a most sincere desize that the subject of our national architecture shall be taken up at this time, treated of, agitated and talked over until our ideas are crystallized and put into practical shape, so that they can be understood and considered by an in-telligent public and their representatives in Congress. The whole theme is so grand, so ennobling, so far-reaching in its results for the glory of our profession, that to be

brief is well-nigh impossible.

The obligation includes a hasty treatment in detail of each subject suggested, and necessarily involves the coneach subject suggested, and necessarily involves the consideration of the Architectural Department of our Government at Washington. After the bill for the erection of a national building has become a law, the question of a proper site is the first consideration. The system by which the sites have been generally selected was, for the Secretary of the Treasury to appoint a commission of not less than three not more than seven contlemen residents of the city where than seven gentlemen, residents of the city where the building is to be constructed, with instructions to recommend a suitable site, and, in most cases, the recom-mendation of these gentlemen has been approved. Theoretically, it is quite natural to suppose that the genthemen so selected would perform their part with honor to themselves and to the satisfaction of the department. The themselves and to the satisfaction of the department. The facts do not bear out any such supposition. The question of what the site was to cost, and its relation to the total amount of expenditure fixed for both site and building, rarely entered into the question with them, excepting, perhaps, to see that the price paid was not exorbitant. Such committees were nearly always swayed by personal interest, local influences, such as a newspaper, a brother member of the church a warm personal friend a poor member of the church, a warm personal friend, a poor widow woman, or some other creature that was found to be the governing cause in the case. The sites so selected were frequently of insufficient area, at times largely in excess of what they should be as to cost, not properly located for Government business, nor for the accommoda tion of the public; examples of which are to be found all over the country. When the site selected was found to be over the country. When the site selected was found to be too small, it was after the buildings had been constructed, and the Postmaster and other Government officers attempted to transact business in their new quarters. obtain then additional grounds and enlarge the build-ing was the only alternative, and when accomplished, was always expensive, and seldom satisfactory. The system ing was the only alternative, and when accomplished, was always expensive, and seldom satisfactory. The system now in vogue is to advertise in local newspapers for a site for the new building, thus allowing those who may so desire to submit his or their proposal. A stated time is fixed when an agent of the department is sent to witness the opening and to hear what may be closed as a likely the complete of the department is sent to witness the opening and to hear what may be closed as a likely that the complete of the department is sent to witness the opening and to hear what may be closed as a likely that the complete of the department is sent to witness the opening and to hear what may be closed as a likely that the complete of the complet the opening and to hear what may be classed as public opinion. Each site is then visited and inspected by the agent and its price and eligibility taken into account.
Upon the written report of the agent to the Supervising Architect, and in turn his recommendation to the Secre tary of the Treasury, action is taken, and the question of site, so far as the Treasury Department is concerned, is

All papers are then given to the Attorney-General, and All papers are then given to the Attorney-General, and upon his certificate that the title is valid, the site is paid for. The paramount requirements are properly met by taking into account the area required for the present volume of business, and for future growth of population, and consequent enlargement of the building, which should always be well and carefully provided for. The site selected should be at the angle of a square, and with its main facades to the south and east, for proper light and the accommodation of the public. The area in all cases should be sufficient, so that an undivided space of not less than thirty feet can be th**e** public. that an undivided space of not less than thirty feet can be maintained upon the two inner facades, as a proper protection against fire from adjacent property, and for a proper circulation of air, and the admission of light. In considering the building proper, the question of the material entering into its composition will largely depend upon nai entering into its composition will largely depend upon its geographical location. It should always be a fire-proof building in every sense of the term, and so planned that additions can be added providing increased accommodations when necessary, while the architectural harmony of design is maintained or increased. The interior should be constructed of the most lasting and durable finish, such as polished domestic marble engagation tiles. polished domestic marble, encaustic tiles, terra-cotta and political control of the political states of the political states. Large openings in walls should occur wherever consistent with permanent and safe construction for a thorough diffusion of light. The floor and roof construction should be of iron or steel, fire-proofed, and with fillings of terra-cotta. In the important question of roof construction, the best results have been obtained by the

use of porous terra-cotta sheathing, set in lime mortar and bolted to T-irons, the whole surface covered with coal, tar r pure asphaltum, with roofing prepared paper, rolled on hile the tar or asphaltum is still hot. The paper will while the tar or asphaltum is still hot. The paper will then adhere perfectly and prevent the passage of moisture, fine drift snow or rain. After the paper is applied the valleys, hip-rolls, gutters and flashings are formed in copper when the whole is slated with 18 thick slate, bolted to place with bolts having countersunk heads and with nuts and washers. When so constructed it can be safely plastered upon the under side, will be durable, and will be found to assist very materially in the heating and ventilating of the building during the cold season, and in the end will be found to be the most economical. In this respect, however. I do not place myself in connection with those The paper will however, I do not place myself in competition with those architects who employ the flat roof or no roof at all. To me any detached building where the climate is as it is in every locality of our country, without a roof to be seen is an architectural innovation. In the distribution of floor space, the basement will be generally occupied for storage purposes, heating, ventilating and lighting apparatus, elevator pumps and machinery. The first floor of the building should be sufficiently elevated, so that the basement can be well lighted without areas, making it available for practical use, and giving a more imposing exterior. It will be entirely taken up by the Post-Office Department, with its main working room, Postmaster's public and private office, the Assistant Postmaster's room, Money Order and Registering Department, Mailing Clerk's retiring room, with stairs, halls, and elevators The second story will provide accommodations for the Internal Revenue Collector's offices, the United States Marshal's public and private office, and quarters for the United States Coast Survey. The third story will be arranged to accommodate the United States District and Circuit Court, with private rooms for the judges, their clerks and library, the United States District Attorney's room, besides lawyers' consulting room, with witnesses' waiting-room adjacent, jury room, halls, stairways, and elevators. The heating of the building should be, in nearly all cases, a low-pressure indirect, mechanical steam-heating and ventilating apparatus. The boilers and all the radiators should be massed in the basement, and by means of a fan the atmosphere of the entire building should be placed in a plus condition, and the supply of fresh air and the ventilation regulated as required by the temperature upon the exterior. The supply should be distributed at the ceiling in all cases, while the ventilation is operating at the bottom of rooms and hallways. The lighting of the building should be by the incandescent electric light, the entire plant to be the property of the Government, and under the control of a property of the Government, and under the control of a competent engineer in charge of the heating apparatus and elevator machinery. Provision should be made for rain-water supply, by the construction of large cisterns outside of the building, into which all conductors should discharge. The tank in the attic should be provided with nine and connection hose on the different floors for use in pipe and connection hose on the different floors for use in case of fire. For other purposes the city water-supply generally proves everything that is desired. What may be considered as the "paramount requirements" of the building in question, then, can be properly condensed into three prime factors: First, a sufficient sum of money; second, architectural knowledge to properly apply it; and lastly, legislative authority, such as is sometimes obtained by accident, seldom by intention. With these three facone, and would be understood as well for a national building as for any other. That they are not given factors in the problem is known to you all, and further treatment of the problem is known to you all, and further treatment of my subject brings me at once to the consideration of the present system by which our national buildings have been, and are now being, constructed. As to the question of money available to construct a building, it is a fact that as many bills are passed by Congress and become laws, authorizing the construction of buildings, restricting and conditioning with great caution the expenditure, and yet omitting to appropriate one dollar, as are passed where the total amount to be expended is appropriated and omitting to appropriate one dollar, as are passed where the total amount to be expended is appropriated and made available as it should be. The great majority of bills that are passed, and by which the Treasury Department is governed, for public buildings, appropriate only a small percentage of the amount fixed in the bill, as the total limit of cost. It is evident therefore, that the Architectural Department of the Government cannot be alled to account for the notorious delays and consequent. additional expense in their construction. Having authorized the erection of a building, why should not the full amount required for its construction be appropriated, so that the work of construction may be carried on with dispatch, and upon sound business principles? That it is not so is a most unaccountable fact upon any other than political grounds. The Lower House of Congress being not so is a most unaccountable fact upon any other than political grounds. The Lower House of Congress being Democratic and the Senate Republican are trying to make a record for economy in appropriations, and while it is possible to pass bills for necessary building, the appropriation committees decline to appropriate the money, and, in my judgment, must assume the responsibility for everything resulting from a policy of inadequate and dribbling appropriations. In considering the second requirement appropriations. In considering the second requirement, that of architectural intelligence, that of the Supervising Architect of the Treasury should be without limit. Under the present system this is certainly a "paramount necessity." He should be so endowed, that at will, should Congress vote the erection of forty buildings at one time, as did the Forty-Seventh Congress, his ability will be sufficient. With eighty new buildings in course of construction, he is expected to make no mistake, and to do all the archi-tectural work with the same facilities that were once re-

quired for ten buildings. What may be classed as architectural is but one portion of his work; he is necessarily an executive officer, and attends personally to a correspondence of upwards of three thousand letters per month, besides hearing contested cases of contractors, holding counsel with Congressmen, Senators and other Govern ment officials. His immediate official superior, the Secretary of the Treasury, may require some education in the ethics of architectural details with which he is not familiar, ethics of architectural details with which he is not familiar, and it is one of the duties of the Supervising Architect to be especially devoted to his case. If, as in my own experience, there should be a Folger, a Gresham, a McCullough, a Manning, and a Fairchild in the space of four years, his duties in this regard are not lessened. Concerning his professional brethren criticism has generally fallen upon him for the architectural taste or style which building it is the crowning element in its relation to the public, posterity and history. How important, then—paramount, indeed—that it should be consistent with the requirements of our people and their peculiar institutions! There should be, in my humble judgment, no hide-bound fetters holding our national architecture to the rigid rules of the classics, but an absolute freedom and emancirules of the classics, but an absolute freedom and emancipation of design in which the governing spirit shall be that of utility, durability, truthfulness, and harmony. I abhor a false window as I do any other kind of a lie. The national building, therefore, should, in its every feature of design, be of a style consistent with our education and our highest art and culture. The time allotted to this paper is so limited that for further information upon this factor of national buildings I am compelled to refer you to "The History, Organization, and Function of the Office of Supervising Architect" of the Government, published by the office in the year 1886, and obtainable there

on application.

As to the third condition, it is paramount that Con-As to the third condition, it is paramount that Congress, in order to embrace in a bill for the construction of a national building the proper legislation, should have sufficient data and knowledge of each case upon which to base an opinion. The facts are, that in the past Congress has seldom sought such information. If the language of a bill and the limit of cost were as they should be, it was purely accidental, the general intention being to get the building started and correct everything at some future purely accidental, the general intention being to get the building started and correct everything at some future session. The unsatisfactory result of this part of the present system are known to you all. I might go much more into detail by way of illustration, but our country is full of object lessons, and time will not permit. I will close with but a few remarks as to a remedy. Certainly nothing will be done towards correcting the present system, until the architectural profession take the initiative and formulate something better, and the responsibility for its continuance rests solely upon them. Congress will be found willing to enact into law any bill which can be shown to be in the interest of a better architecture and a more economical administration. The first step, theremore economical administration. The first step, therefore, is for the American Institute of Architects, together with the Western Association, to formulate and agree upon a measure which meets every phase of the case in detail, and which, when presented to Congress, will be the basis upon which every architect and the public at large can intelligently demand its enactment into law. If we ourselves are incapable of this, complaint and fault-finding with the present system and its work will be useless. objects to be attained are a higher art in the National Building Architecture and a more effectual and economical administration in their construction. The public are much more interested in this matter than are the architects them-Selves, and ignorance of the subject is our enemy to fight.
Our architectural journals and the public press are the Our architectural journals and the public press are the means by which to get the proper information to the people, and when there its effect will at once be felt in Congress. Personally, I have not hesitated to go on record in my reports to the Secretary of the Treasury as to what, in my opinion, should be done and which in general terms is to create a commission or board of public buildings, composed of the Supervising Architect, an assistant supervising architect, a heating, ventilating and buildings, composed of the Supervising Architect, an assistant supervising architect, a heating, ventilating and sanitary engineer, and a master builder, with the Secretary of the Treasury as ex-officio member. We are happily reaching an age of specialties, and it is but reasonable that those who are experts in a special branch of work should be the safest and best guides to success. The combined intelligence of such a board will justly inspire confidence in the public mind and also in Congress, while our profession can safely trust the question of competitive plans to their judgment. I am as much opposed to a promiscuous competition for a national building as I am to miscuous competition for a national building as I am to one for a private or any other public building, and what architect, who has obtained by ten or twenty years' of laborious study, hard work and responsibility a just reward in reputation, would care to risk it with those soto gain. There should, therefore, be a standard adopted to gain. among architects which shall determine effectually their claims to the title, upon the corner-stone of which should be inscribed indelibly the words Honesty and Ability.

Life is too short for further delay. Let the work

Life is too short for further delay. Let the work already performed in this direction be weighed for what it is worth; but let not this convention adjourn until it has gone on record as to what it knows about the paramount quirements of a national building for custom-house, judicial and postal purposes.



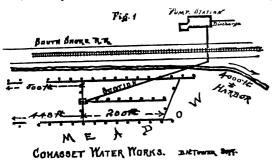
RECENT WATER-WORKS CONSTRUCTION. No. XV.

COHASSET MASS.*

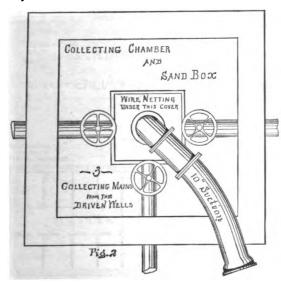
This pretty seaboard town lies on the line of the Old Colony and South Shore Railroads, about an hour from Boston, and contains some 3,000 inhabitants. There is no manufacturing and scarcely any trade or commerce in the place, but it furnishes a home for Boston merchants, and the remnants of a once profitable fishing business may be discovered by the curious observer.

The usual preliminary talk about a water-supply for the town began about two years ago, but not until the close of 1885 was any important step taken. At that time Mr. Daniel N. Tower, a civil engineer, well known along the South Shore, took up the matter in earnest, and, having succeeded in enlisting Mr. Charles S. Bates, a wealthy summer resident, the construction of a first-class system of water-works was assured. Work was fairly begun in May, 1886, and the main lines, reservoir, and pumping-station were completed by December. The work of laying services has been commenced. The interesting portion of the plant is found in that devoted to supply.

In a meadow lying on the westerly side of the railroad, and forming an evident basin for no inconsiderable water-shed, are sixty-five driven-wells, 2 inches in diameter, 24



feet apart and driven from 30 to 40 feet deep. Four feet below the surface these wells are connected by horizontal cast-iron mains of diameters varying from 4 to 10 inches, and connecting, as shown in Figs. 1 and 2, with a sand-box and gate-house. As the water leaves the cast-iron sand-box through the 10-inch suction it must first pass through a screen of copper wire. It is worthy of note that an air-chamber on top of the sand-box, which was thought essential in the construction of the driven-well system at Hyde Park, has been omitted at Cohasset with good results. The meadow is nearly a mile from the salt water of the harbor, but its surface is only 4.65 feet above mean high tide. The brook shown in Fig. 1 usually runs dry in summer.



As a rule, the wells go through the following strata: Meadow muck, I foot; clay, 5 feet; sandy loam, 8 to 10 feet; gravel, I foot; blue clay, 10 to 15 feet, and then into a good water-bearing gravel of unknown thickness.

The pumping-plant consists of a brick engine and boiler-house, 26x49 feet, with 12-inch walls and a hip roof of 2-inch hard pine plank covered with selected slate, a Blake compound condensing duplex pumping-engine 8x16x8½ x12, capacity 750,000 gallons in 24 hours, and one boiler.

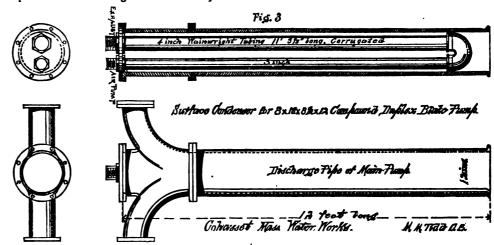
There are six miles of cast-iron mains, the largest being twelve inches in diameter. The reservoir is on the crown

*No. XIV., The Water-Works of Calais, Me., was published on page 519, issue of October 8, 1887.

of James Hill, south-east from the heart of the town and the pumping-station. It has a capacity of 1½ million galons, and is in construction identical with the one built for Hyde Park. Mass.

Plans for this and all other portions of the work were prepared by Mr. Tower under the guidance of M. M Tidd, C. E., of Boston, who was engaged as consulting engineer.

The reservoir was built and the street-mains were laid under contract with W. C. McClallan, of Boston, and the work was performed in a thorough and satisfactory mancrete by the Romans, and lava flags, as in Naples and Catania. Macadam was certainly condemned for heavy traffic in all large towns as being too costly in maintenance and too disagreeable owing to its dust and mud, choking of drains, making mud-banks in rivers, etc., and the tendency of the day was to substitute for it a noiseless pavement. The macadamized road of the Champs Elysées, Paris, now nearly all replaced by wood, cost for maintenance 17 francs per square metre per annum, say 13s. 8d. per square yard; that of the Boulevards, 6s. 8d. per square yard. The proper way to lay wood was upon a smooth cement concrete. Concrete was being used in Paris now as a foundation for granite sets, as in Berlin



ner. Much of the main-pipe trenching ran through hard granite ledges, and about 1,200 cubic yards of ledge was removed by "Rackarock" powder and steam-drills, at a contract price of \$3 per yard.

The works cost about \$75,000, and are owned by the Cohasset Water Company, of which Charles A. Welch is President, James H. Bouvé, Treasurer, Caleb Lothrop, Registrar, Charles S. Bates, Managing Director, and D. N. Tower, Superintendent.

PAVEMENTS AND STREET RAILROADS. No. XX.

(Continued from Vol. XVI., page 710.)
WOOD PAVEMENT IN THE METROPOLIS.*
CORRESPONDENCE.

The author having alluded to the wood pavement laid down by the Improved Wood Company in Paris, he would make some remarks on that interesting work, having watched it daily from its beginning. It had been carried out in September, 1881, on a portion of the Boulevard Poissonniere, of the Rue Montmatre, and a cross-road formed by the two. The gradient of the former was nearly four in 100. It had been laid by skilled English workmen, with the thicknesses of concrete and wood as above stated, and had resisted up to the present some of the heaviest traffic in the world. It was fair to state, however, that the winters of 1881–2–3 had been remarkably mild, and the summers of 1882–3 remarkably cool. In March, 1884, the first repairs had been effected, and now (July, 1884), although the road was in good order, some of the sets had become spongy, and those in the lines of traffic were rounded at the edges. On a wet day the wheels of the omnibuses, by expressing the surface-moisture, left seemingly white tracks behind them. Now, large surfaces of wood pavement were being laid all over Paris, chiefly in substitution of macadam, and four rival contractors were in the field. The price for all is as near alike as possible, say 23 francs the square metre, or 14s. 10d. the square yard; but it must be noted that the Paris octroi on cement was 12 francs the ton, and on wood 7 francs 50 cents the cubic metre, which increased the cost price by about 1 franc 50 cents the square metre, or say 1s, the square yard as compared with that of London. The system of deferred payments had been, adopted all round; the prime cost of 23 francs was spread over a period of eighteen years, interest and compound interest being allowed on both sides at the rate of 7 per cent. per annum. This gave two francs 35 cents per annum for first cost, to which was added for maintenance 2 francs 85 cents per square metre per annum for first cost and maintaining, for a period of eighteen years, or 3s. 1d. per square yard. This price had been subsequently increas

* A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings

and Vienna. Wood might answer for wide, well-ventilated thoroughfares, but to use it for narrow streets was antihygienic. Wood absorbed the urine of horses and the diluted filth of the streets; horse-dung clung to it, and in dry weather it gave rise to horse-dung dust.

dry weather it gave rise to horse-dung dust.

For traffic, wood was excellent for the first two or three years, but as soon as it became fibrous and worn, like an old tooth-brush, it would certainly give off poisonous emanations under a hot sun, and remain damp in winter. It lacked that first quality for a hygienic roadway of impermeability; and was far less durable than asphalt; for Cheapside, laid in asphalt in 1878, had never been renewed, and its repairs had never stopped the traffic for one minute since it had been laid, whereas wood was entirely renewed in six to seven years. It might be safe-predicted that a reaction would set in against wood within the next few years. The Paris engineers stated in article 19 of their specification for wood pavements: "The administration reserves to itself the faculty of suppressing at any time any part whatever or even the whole of the roads paved with wood." He might add that the cost of the compressed asphalt pavement now being laid round and inside the new Hotel des Postes, Paris (about 10,000 square metres), consisting of a 6-inch Portland cement foundation and asphalt 2 inches thick was 19 francs 50 cents the square metre, say 123. 5d. the square yard, and the yearly maintenance for ten years 2 francs per square metre, or 1s. 4d. per square yard. In the Rue de Richelieu the two systems of noiseless roadways, asphalt and wood, had been laid this year side by side; a few years would prove which of the two possessed most dury blike.

foundation and asphalt 2 inches thick was 19 francs 50 cents the square metre, say 12x. 5d. the square yard, and the yearly maintenance for ten years 2 francs per square metre, or 1s. 4d. per square yard. In the Rue de Richelieu the two systems of noiseless roadways, asphalt and wood, had been laid this year side by side; a few years would prove which of the two possessed most durability.

Mr. H. Faija said that as it seemed to be admitted that the life of wood pavement was dependent, to a rather important extent, on the foundation on which the wood-blocks were laid, he agreed with the author that it was better to have good, clean ballast for the formation of the concrete, than to use the broken granite which existed in the old roadway, from which it would be hardly possible to make a good concrete. Even after the granite had been screened it was very dirty, and all the holes and interstices, which for the production of concrete should be filled with cement, were filled with dirt. Then, again, the screening removed not only the large pieces, so that to secure a sound concrete a much larger quantity of cement would have to be used than was necessary with the ballast. But as this extra amount of cement was not used, the concrete was very rough, very open, and consequently neither strong nor sufficiently smooth to receive the blocks; it was therefore necessary to lay a surfacing of sand and cement on which to set the blocks. This surfacing must, in time, break up and become reduced to powder, for it had not a thickness sufficient to resist hard wear, nor was it homogeneous with the concrete underneath. The author had stated the cost of the concrete at 2x. 3½d. The square yard, and it was therefore evident that if the concrete had to be relaid or materially repaired every seven years when the blocks were renewed, the maintenance would be considerably increased beyond the figures given in the paper; and might probably account for the high cost of maintenance which exist in the Holborn District. In fact, the concrete

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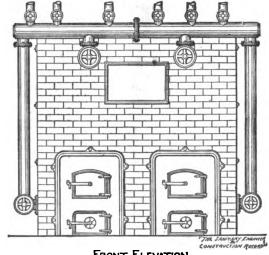
WARMING THE WESTCHESTER COUNTY ALMSHOUSE BY HOT WATER.

On account of the interest now being taken in hotwater work we have gone to the trouble and expense of working up the heating-apparatus, etc., of the Westchester County Almshouse, at East View, Westchester Co., N. Y., just as it has been put in by the Denny Bros. Co., of this city, that our readers may have as great facility to see what has been done there in this line as if they visited the

Figure 1 is a plan of the rooms of the building that have been warmed by this system, and which have been tested during one winter, 1886-7. They comprise all of the rooms of the first, second and attic stories of the main building, and the first and second stories of the hospital building; the asylum wing being as yet heated by the furnaces. The building is a very old one, of solid masonry, and is in good repair.

Figure 2 shows the basement plan and the position of the pipes and boilers, as well as the male and female

coils. Its branches are 11/4 and 11/2 inches to the coils-11/4 inches to coils of 50 square feet and 11/4 to larger coils. The return-pipes are similar, but in this case are on or near

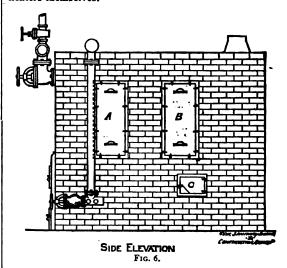


FRONT ELEVATION FIG. 5.

the floor so as to get the water back to the boilers, as the heaters are nearly as low as the bottoms of the boilers.

The loop a, Fig. 3, with air-chamber, was introduced for the purpose of quickening the circulation to the lower floor.

ence of the density of the water in the legs. The motive power, then, for the basement-considering gravitation as the cause of motion—is in the down-leg of this syphon and the pipes which drop to the coils and heaters and the heaters themselves.



The amount of heating surface on the first or principal floor, main building, is about 1,383 square feet, part Bundy hot-water radiators and part box-coils. A close study of the plan will show the different locations, the coils being

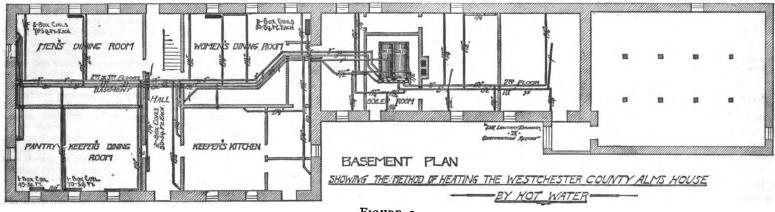
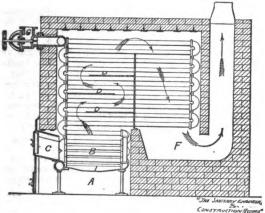


FIGURE 2.

dining-rooms, keepers', and other rooms that are warmed in the basement.

Figure 3 is an isometrical drawing of all the flow-pipes as they are used and their sizes, and a reference to the plan (Fig. 2) shows plainly their relation to the building. The return-pipes, not shown, are almost identical with the flow-pipes so far as position is concerned, and in size they are equal.

It will be noticed a separate flow and return pipe is used for each floor, with the exception of the third, which is warmed by branches of the second-floor system. The

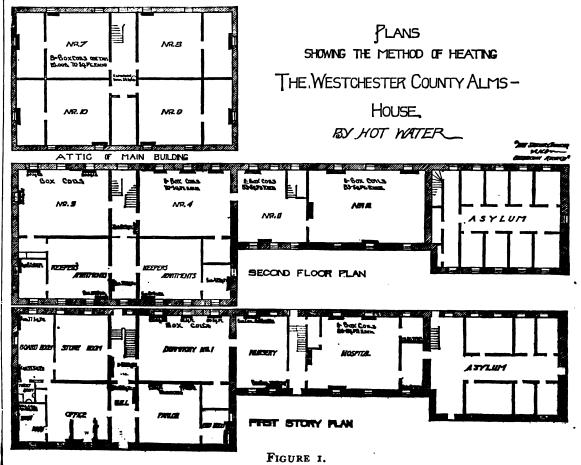


LONGITUDINAL SECTION F1G. 4.

basement contains about 450 square feet of surface, not considering the surface of the mains, and for this amount of surface, under the limited height of the basement, eight feet, the main or flow-pipe C starts 21/2 inches in diameter from the cross-drum at boilers and is carried up to the level of the second floor (a), within a closet, where an air-chamber and air-vent is attached, thence down again to the level of of the basement ceiling, close under which it runs. At the hall under the centre of the main building it reduces to 2 inches, and at the end it is 11/4 inches to the two last The up-leg of the loop and the pipe from the boiler is carefully covered, the object being to secure as great a difference of temperature between the legs as possible, or, in other words, to secure a greater loss of heat in the downleg, and consequently maintain a greater constant differ-

marked "Box-Coils," and the radiators "Rad." There is no advantage in the use of radiators or coils in one position over another, excepting appearance, the radiators being in the best-finished rooms, parlors, etc.

About 843 square feet of this surface is in the centre





building—first floor—and 540 square feet in the nursery and hospital. The pipe to the main part of the building (A) starts three inches in diameter and runs, as shown, under the basement ceiling. About the middle of the building, under the hallway, it reduces to two inches, thence runs to the end of that diameter. To any one particularly interested in the matter, all its branches can be traced in Fig. 3, with their sizes, etc. The pipe to the nursery and hospital part is $2\frac{1}{2}$ inches (A, right, Fig. 3), and is run as shown and marked, and requires no more explanation from us, as it may be traced on the drawing easily

The pipe B B in the drawing is for the second and third floors. It is 3 inches to the main building and 2½ inches to the centre building, and can also be traced, with the quantity of surface, at each branch.

In a few cases a pipe branches to two radiators, or coils, but usually a separate riser goes to each heater. The third floor, however, is always a continuation of the second story riser, though of a smaller size. and the door C is to remove ashes from the flue F. The dimensions of the walls, etc., on the ground plan are given. The elevations show the positions of the stop-valves and connections, and also the fire and draught doors. Each boiler in this case has a separate chimney.

The total heating-surface in the building is about 3,860 square feet, not including any of the running pipes. The boiler surface is about 700 square feet; the total area of the flow-pipes 29.1 square inches.

The expansion-tank is in the attic, and is connected with the headers of the boilers inside all valves by a 1-inch pipe. The pipe connects with the bottom and side of the tank, the side connection being to prevent hot vapor escaping within the water. Its capacity is 18 gallons, and it has a water-glass two feet long.

The extreme length of the buildings is 200 feet, and the ceilings of the first and second stories are 10 feet 9 inches and 10 feet 6 inches respectively, so that any one who is interested in the ratio of heating-surface to cubic arrangement of overflow-pipes. Ordinarily tanks have overflow-pipes open to the roof-gutters of building, with perhaps a running trap in them to prevent the ingress of cold air, or they are trapped and arranged like other fix-

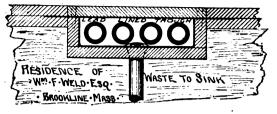


FIG. 8.

tures when they must go to a sink which connects with the sewer. The objection to these contrivances is the danger of syphoning or forcing the traps, or of their being evaporated or frozen. To overcome this the arrangement

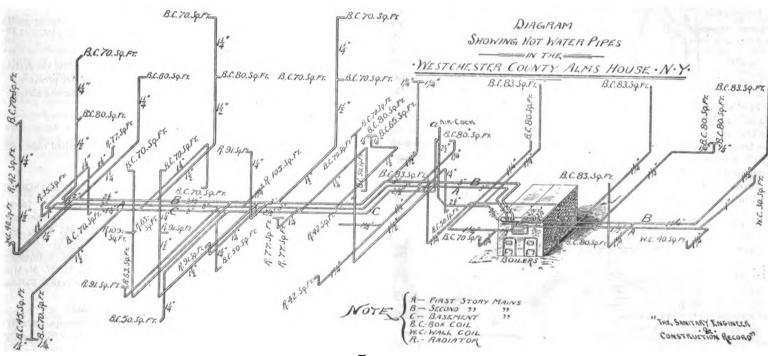


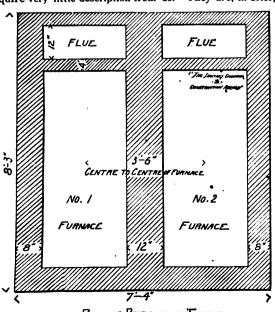
FIGURE 3.

BOILERS.

The boilers used are shown in Figs. 4, 5, 6, and 7, being respectively longitudinal section, front and side elevation, and ground plan.

They are Garth's twin hot-water boilers, and each contains 700 feet of extra heavy 1½-inch pipe. They are separately connected, as shown, by a 6-inch header, with 4-inch connections from each boiler.

The drawings show thoroughly what the boiler is, and require very little description from us. They are, in brief,



PLAN OF BRICKWORK FOR FURNACE.

box-coils, with the fire-box or furnace sides formed by flat coils. The heat of the fire, after leaving the furnace, is made to travel about the baffle-plates D D to the top, thence down the rear to the flue F. Doors are provided for cleaning at the sides A B, so as to reach all the tubes,

contents of rooms, etc., can approximate the latter by dividing the whole length into tenths and hundredths and using it for a scale.

The contractors were the Denny Brothers Company, of 34 Park Place, and their engineer who carried out the work was Mr. W. M. Mackay. The Heating Committee were Messrs. Miles Adams, Joseph B. See, and Moses W. Taylor.

SOME SKETCHES OF PLUMBING IN THE RESIDENCE OF WILLIAM F. WELD, ESQ., BROOKLINE, MASS.

No. III.

(Continued from Vel. XVI., page 743.)

In our last issue we treated of the water supply of this building. The tanks, Fig 7, there shown have a peculiar

shown in Fig. 7 was devised. It is simply a bottom connection taken from the tank and carried up outside of it to the water-line, thence down to the roof-gutter. A vent-pipe runs from the top of the overflow thus formed to prevent syphoning, should it become changed during the period of relieving the tank. Of course, with this arrangement, the trap can never be emptied while there is water in the tank, nor can cold air blow in to freeze the water.

Underneath the tank is a leaden safe, with drip-box for trap, etc. This box has a safe-waste from its bottom in the usual manner to a sink in the basement. All the running pipes of the house are treated in the same manner as shown in Fig. 8.

Figure 9 shows the details of a basin. The exposed pipes are all polished and plated brass put together with brass unions. Figure 9 shows a detail of the arrangement

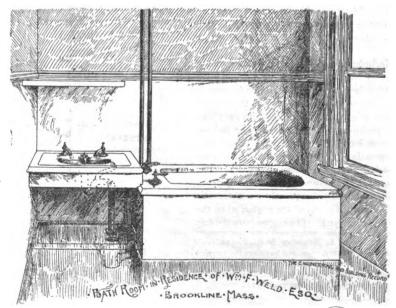


Figure 10. Digitized by GOOGLO

of the bath-tub and wash-bowl shown in the bath-room, Fig. 10. The bath-tub is ceramic ware, with a standing overflow. The bowl is an oval Pemberton bowl of large size, and the general appearance and arrangement of the room can be obtained from the sketch.

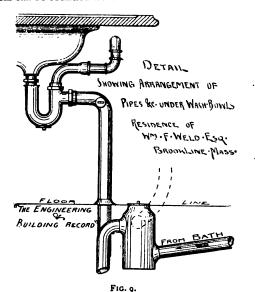


Figure II is a special arrangement of photographer's sink fitted on the top floor of the house. It is made of soapstone I½ inches thick, and has a drain-board at each end. The length over all is five feet. The length of the sink proper in the centre is three feet, by two feet wide, and its total height, including back, forty-two inches. It is set on an oak frame with heavy turned legs. The whole is set in a large leaden safe in the floor of the dark

for the purpose indicated. These two classes of steamelevators may be classified as:

(a) Intermittent. (b) Continuous.

The second general classification—viz., the hydraulic elevators—are those in which the static pressure or head of water is the source of energy, and is employed in a hydraulic engine. This static pressure may be due to either:

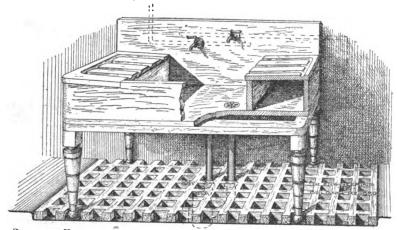
- (a) The natural head of the fluid, as in the case of many cities where the source of supply is higher than the point where the water is used.
- (b) The artificial head produced in a city water system by pumping from the source of supply to a higher reservoir, a stand-pipe, or, as in the case of the Holly Water System, by pumping directly in the pipes.
- (c) The artificial head produced locally in a building by the use of a steam-pump to give head to the water by pumping to an elevated tank, or else to deliver water into the hydraulic engine.

The third general classification—viz., the belt system of elevators—includes those in which the prime mover is of sufficient size to run an elevator in addition to its usual load, by means of shifting belts on fast and loose pulleys. This class of elevators is similar to the continuous steam-elevators above described, with the exceptions that there is no direct contrivances for the reducing of either pressure or speed, except the ordinary governor, when the elevator is not in operation, in the motor, and that the motor is used for other purposes beside the elevator.

For the sake of simplicity in our consideration of economy, we shall designate the respective classes as follows:

- A. Intermittent steam-elevators.
- B. Continuous steam-elevators.
- C. Hydraulic elevators actuated by the head of water derived from a city street-system.

 $\mathbf{D_1}.$ Hydraulic elevators actuated by the head of water



·SINK IN RESIDENCE OF WM·F·WELD·ESQ· BROOKLINE· MASS.

room, the safe being depressed about two inches below the actual floor-level. The legs of the sink, which rest in the safe, are set into leaden cups that are wiped on the bottom of the safe. A grating of hard wood is set into the safe so as to restore the level of the floor. The dotted lines show the trap beneath the safe.

(To be continued.)

THE MOST ECONOMICAL ELEVATOR.*

THE elevator systems at present employed in buildings are classified as follows: 1, Steam; 2, Hydraulic; 3, Belt.

The first class includes those in which a steam-engine is connected directly, by means of gearing or belting, with the drum upon which the cable operating the car is wound, the engine running, by means of a valve under the control of the operator, only when required to raise the car; and those in which a steam-engine is connected by belting running on fast and loose pulleys with the drum upon which the cable operating the car is wound, the engine running continuously, although the mean effective pressure, controlled by an ordinary governor, is reduced when the elevator it not in operation. Frequently an automatic contrivance for reducing the speed of the engine when the elevator is stopped is employed. The engine is used solely

*This article, by Mr. Edward E. Magovern, M E., first appeared in the Stevens Indicator of January, 1887, and has since been copied in English and continental exchanges. It embodies the result of tests made by the author on elevators supplied by the New York Scam Company, where he was engaged as assistant engineer.

derived from a local pressure induced by the pumping water to a roof-tank.

D₃. Hydraulic elevators actuated by the pressure of water pumped into a closed tank.

E. Belt elevators.

The economy of the system may be taken as follows:
1, Initial cost; 2, Cost of repairs; 3, Cost of attendance;
4, Cost of motive power, including lubricating, etc.

The following tables are based upon the results of a five years' experience with upwards of six hundred elevators of standard makes in the city of New York:

COST OF MOTIVE POWER .-- (Value 100.) Comparative Figure.E.... 12 D₁..... 18В.... 40A..... 6 maximum D₂ 100 INTEREST ON INITIAL COST.—(Value 331/3.) 1 minimum..... .E.... ... 15 B...... 45 D₁.... 90 6 maximum...... 100 COST OF REPAIRS.—(Value 271/2.) **F.**

COST	0 F	ATTENDANCE.—(Value 95.)	
ı minimum		E	to
2	· • • •	B	30
3		C	50
4		D ₁	75
5		A	85
6 maximum			100

Taking the cost of material and other items involved as at present time in the city of New York, the comparative figures for elevators doing the same work (i. e., of same lift, number of trips per day, and loads lifted), were obtained.

Manifestly, the elevator, the sum of whose resultant comparative figures is a minimum, is the most economical. The following table, therefore, gives the most economical elevator when the four facts above are considered:

THE MOST ECONOMICAL ELEVATOR.

Total maximum values, 33½ + 27½ + 95 + 100 = 255\$.

		Comparative 1 ik
ı minimum	 E	51.25
2		77.6
3		111.
4	D ₁	130.25
5		191.58
6 maximum		

Other items which frequently affect the decision are:

- 1. Want of necessary street-water pressure.
- 2. The requirement of more than one elevator.
- 3. Smoothness of motion.
- 4. Comparative safety.
- 5. Variations of load.
- 6. Peculiarities of situation, limited room, etc.

ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of this society for the present session was held on November 16 at the Institution of Civil Engineers, London, Mr. W. Ellis, F. R. A. S., President, in the chair.

Mr. C. E. de Bertodano, Dr. W. A. Bowen, Mr. F. J. Brodie, Dr. T. B. Hyslop, Prof. H. H. McMinnies, and Captain T. C. Newton were elected Fellows of the society.

The following papers were read:

(1) "The Use of the Spectroscope as a Hygrometer Simplified and Explained," by Mr. F.W. Cory, F. R. C.S., F. R. Met. Soc. The object of this paper is to suggest as simple a way as possible of using the spectroscope as a hygrometer in order to facilitate its introduction amongst observers as a standard meteorological instrument. The best form of hygrospectroscope as a recognized standard for the purpose of investigating and scrutinizing the changes of the three parts of the spectrum mentioned is that originally termed by Mr. Rand Capron "The Rainband Spectroscope." It ought to have a fixed slit, and, in addition, a milled wheel at the side for the easier adjustment of the focus. The author concludes by giving a set of hints to observers for taking weather observations with a pocket spectroscope.

(2) "Rainfall on and around Table Mountain, Capetown, Cape Colony," by Mr. J. G. Gamble, M. A., M. Inst. C. E., F. R. Met. Soc. The author calls attention to the great and, in some respects, peculiar differences that exist between the quantity of rain that is registered on and around Table Mountain. The most striking feature is the small fall on the signal hill, called "The Lion's Rump," which lies to the west of Capetown, between it and the Atlantic. The average annual fall there is only 15 inches, while the fall at the western foot is 21 inches, and in Capetown 27 inches. The signal hill is 1,143 feet above the sea. The fall at Platteklip, on the northern slope of Table Mountain, overlooking Capetown and 550 feet above the sea, is considerable-namely. 45 inches. The greatest fall is at Waai Kopje, about half a mile to the southward of the highest point of the mountain, at an elevation of 3,100 feet, or 450 feet below the top. Another station on Table Mountain further south, that is, to the leeward in the rainy season, and 2,500 feet above sea-level, has only 39 inches. The Eastern suburbs, Rondebosch, Newlands, and Wunberg, all have a comparatively abundant rainfall, 40 to 50 inches and upwards, the greater part of which falls in winter-time.

(3) "On the Cause of the Diurnal Oscillation of the Barometer," by Mr. R. Lawson, LL. D. The object of this paper is to show that the diurnal oscillation of the barometer is mainly due to the combination of the earth s rotation with its orbital motion.

BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXVI.

(Continued from Vol. XVI., page 677.)

MATERIAL LOCK USED IN THE PNEUMATIC CAISSONS AT THE FORTH BRIDGE.*

[Prepared for THE ENGINEERING AND BUILDING RECORD by F. W. Moir.]

THE illustrations in this week's issue represent two sectional elevations of the air-locks used for the removal of the material from the working chamber of the pneumatic caissons which were employed in the foundation of the cylindrical piers of the Forth Bridge. They were bolted to the head of a 3'6" shaft by the flange at their base, at such a level that they would always be above high-water mark at the lowest position of the caisson. The bucket is shown in the space, which becomes the intermediate chamber between the atmospheric and the higher pressure within the bell. This space is closed at either end by sliding doors D and D, which can be drawn back, or pushed forward by means of the hydraulic rams H and H, or the toothed racks and hand-wheels. To prevent the possibility of both the doors being opened at the same time, which would allow the high pressure air to escape, the following ingenious plan was adopted: the hydraulic valves controlling their opening and shutting, were made to lock one another. The way this was done will be understood by reference to the hand-wheels, D, D, Fig. 1. Each wheel, in its rotation, traverses a portion of the space, which is common to both; to allow

the main supply from the pumps. A whistle is provided on the side of the lock, which is made to sound by the lifted bucket as soon as it is at the right height. There is also an indicator to warn the engineman when to stop winding.

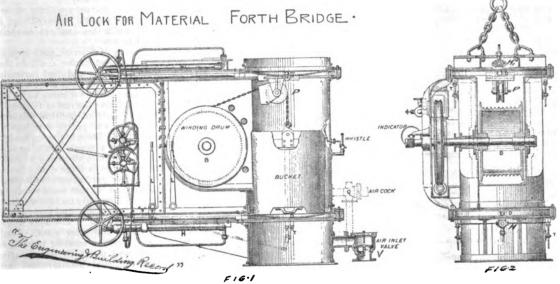
Air-locks, made as described, were used for the removal of both rock and boulder clay, with the greatest success, in the sinking of all the 70-feet cylinders at the Forth Bridge, without a single accident.

(TO BE CONTINUED.)

THE PERILS OF CAISSON SINKING.

THE following is an extract from a lecture on "Bridging the Firth of Forth" delivered at the Royal Institution by B. Baker and reported in Engineering. It is hardly necessary to say that Mr. Baker and Sir John Fowler are the engineers of the Forth Bridge. It forcibly recalls the disaster in the Hudson River tunnel some years since when so many men were drowned:

The process of sinking was as follows: The caisson being seated on the soft mud which, of course, practically filled the working chamber, air was blown in and a few men descended the shaft or tube of access to the working chamber in order to clear away the mud. This was done by diluting it to the necessary extent by water brought down a pipe under pressure, and by blowing it out in this liquid state through another pipe by means of the pressure of air in the chamber. It was found that the mud sealed the caisson so that a pressure of air considerably in excess of that of the water outside could be kept up, and it was unnecessary to vary the pressure according to the height of the tide. In working through this soft mud both intel-



of this, each wheel has a portion of its circumference removed; and that in such a position that it faces the opposite spindle when the door which it controls is closed, thereby allowing the other to turn, if necessary, to open its door. In Fig. 1, for example, the upper wheel D is in such a position that its door is closed, and it cannot turn, as the lower wheel has just been turned to open the lower door D.† The doors, the bearing faces of which are circular, are forced upwards by the air-pressure on their under side against a packing ring of rubber, and they drop one-quarter of an inch clear of this packing when the pressure is equalized.

To insure their quickly making an air-tight joint, after the pressure commences to increase, they are lifted by the bolts T T and the hand levers L. The upper door has swivelled to its under side the pulley block P, through which is passed the chain that heaves up the bucket to the drum B, revolving in an extension of the intermediate chamber. The drum-shaft passes through a stuffing-box, and has keved to it a worm-wheel W I, which is made to revolve by the worm W, driven direct on the crank-shaft of a pair of high-pressure engines. Q is the cock, by means of which the air in the intermediate chamber can either be reduced to the atmospheric pressure, or increased to that inside the bell. V is the air-inlet valve, for

* The tube riveting machine was illustrated and described in the issue of ()ctober 22, page 582.

+ Some four years ago this identical device was used in this city for a precisely semilar purpose, and by means of rods attached to pins on the wheels it controlled also the motion of a swinging pipe some d.starce away, whose position had to bear a fixed relatio opening and closing of the two cocks on whose stems the wheels were placed.-ED

ligence and courage were called for on the part of the men, and it is a pleasure and duty for me to say that the Italians and Belgians engaged on the work were never found wanting in those qualifications. There was always a chance of the caisson sinking suddenly or irregularly, and imprisoning some of the men, and indeed on one occasion a few men were buried up to their chins in the mud, and on another the caisson gave a sudden drop of seven feet. Happily, no serious accident happened, although I confess that I felt a little apprehensive myself, as I was familiar with the details of an accident with a similar caisson sunk in the bed of the Neva at St. Petersburg in 1876. In that case the wet mud rose rapidly in working chamber when the caisson sank suddenly eighteen inches one day, and of the twenty-eight men in the chamber nine remained imprisoned. Of these two managed to get their heads into the shaft of access, and were taken out alive after twenty eight hours, and the remaining seven were smothered in the mud. It was nearly a year before sinking was renewed. Again, in 1877, one of the air-locks suddenly gave way, and of the men then in the chamber three escapeo uninjured, nine were blown out by the rush of air, and, falling into the water and on craft, were mortally injured, whilst twenty were smothered in the caisson. It was thirteen months before the chamber was accessible, and then the vitiated atmosphere in the charnel-house below rendered it very difficult to work. Happily nouse below rendered it very difficult to work. Happily we had no such experience at the Forth."

M. WYATT PAPWORTH publishes very full "Notes on the Superintendents of English Buildings in the Middle Ages," supplemented by a paper by the late William Burges upon "Architectural Drawing in the Middle Ages." Both of these papers are well worth study of all those who are interested in the history of architecture, but our space will not allow us to give a satisfactory review of

REMARKABLE MEETING OF TUNNEL HEAD-INGS ON THE NEW CROTON AQUEDUCT.

SIR: I notice, with pleasure, the account you publish, on the 26th inst., of the accurate work of the engineers employed on the New Croton Aqueduct in the meeting of their tunnel headings. But such work is not altogether "unprecedented," as you style it, though highly creditable and quite close enough for all practical purposes.

A precedent of similar accuracy occurred in joining the headings of the Hoosac Tunnel east of the central shaft on December 12, 1872 As I had been responsible for the line. I was present on that occasion, and tested the alignment with the large transit used on the work. The lateral error, as I measured it, amounted to $\frac{1}{18}$ of an inch, or $\frac{1}{180}$ of a foot, while the vertical error was scarcely more in amount. The problem there had been to extend the tunnel line from the bottom of a shaft 1,000 feet in depth, encumbered by sixty-four separate floors and from a base encumbered by sixty-four separate floors and from a base of 23 feet, which was the greatest diameter of the shaft. The heading was thus extended for a distance of 1,563 feet to meet the eastern workings, which had penetrated the mountain a distance of 11,274 feet, or over two miles from the east portal. Although this long heading depended for its alignment on a long base outside, the shaft was nearly three times as deep as that on the Croton work; and the difficulties arising from smoke and fou in such and the difficulties arising from smoke and fog in such cases increase even faster than the length of headings.

During the progress of such work many refinements of detail are adopted by the engineers in charge, which in these two cases might have been simplified, perhaps, without leading to errors of practical consequence. But engineers in such positions feel the responsibility keenly, and are not to be blamed for seeking a degree of accuracy be-yond what may be practically important as a result.

In the meetings of the Mt. Cenis Tunnel an angular

variation occurred about ten times as large as at the Hoosac, amounting to no less than a "half a yard" at the point of meeting. Yet this was considered at the time entirely satisfactory, and was described as being "almost exact" in the point of satisfactory. act" in the printed accounts. Boston, Nov. 28, 1887.

EDWARD S. PHILBRICK.

[The account furnished to and printed by us indicated a very close, if not absolute, coincidence of the drill-holes, which certainly appeared to be much closer than anything we remembered in that line. In a subsequent letter from Mr. Wheeler he stated the error to have been five eighths of an inch.

We are sure our readers will pardon our unintentional misstatement, since it has drawn this interesting letter from Mr. Philbrick. We remember at the time reading of the very accurate work done at the Hoosac Tunnel, and are very glad to receive this account from the man who did it. It is stated that the error of alignment in the Musconetcong Tunnel, 5,000 feet in length, was only 300 of an inch, but we confess that we would like to have this confirmed.-ED.]

LONDON CORRESPONDENCE.

AT a subsequent meeting the Court of Common Council rescinded their folly in cutting down the expenses in connection with the office of City Architect, referred to in a previous issue. It was very properly urged by one of the members that "the primary consideration with the Corporation must be to secure the services of an officer not only competent to discharge with the greatest possible efficiency the duties of the allied professions of an architect and surveyor, but who shall also be possessed of such professional and social status as to justify the court in entrusting him with the large expenditure and numerous responsibilities which do and must always attach to the supervision and control of the city buildings, and the professional management (under the direction of the court) cf the corporation property in the city."

THE last general assembly of the "Verein für Gesundheitstechnik" was recently held in Vienna. The following were amongst the papers read: By Engineer Hartmann, on "Automatic Regulation of Heating Apparatus;" Engineer Rella, on "Sewerage;" Baurath Mihatsch, on the "Vienna Well-Water Supply," and Engineer Coglieviner on the "Lighting of School-rooms." The next meeting will be held in Dusseldorf.

THE Russian Government has just completed a loan of 25,000,000 roubles in Paris, to be devoted to the building of the Pevekok Canal in South Russia. The canal will allow of direct communication between the Don River and the Black and Azov seas. Although this is to be a strategic canal, yet it will have commercial value in developing the coal resources of the Don, and bringing it into strong competition with the English coal, which is generally used in Constantinople and the Black Sea regions.



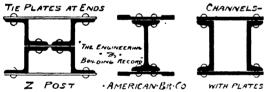
EXPERIMENTS UPON Z-IRON COLUMNS. BY C. L. STROBEL, M. AM. SOC. C. E.*

ABOUT a year ago the writer was called upon to prepare plans and specifications for the superstructure of the new bridge of the C., M. & St. P. R.R. over the Mississippi River at Kansas City. 1,545 lineal feet of this structure is a double-track iron trestle-work of forty-five feet average height. Important advantages could be secured for this part of the structure by adopting a new form of cross-section for the compression members, consisting of four Z-irons joined by lattice-bars in the middle. As Zirons were not at the time rolled in this country it was necessary to prepare rolls especially for the purpose. It was found that the rolling of the Z-iron presented no greater difficulty than the rolling of ordinary angle-iron. Notwithstanding the higher price charged because new rolls had to be prepared, the Z-iron was furnished by the mill at a much lower rate per pound than channel bars, for which they acted as a substitute, could have been bought for, and a considerable saving in cost of the structure was thereby effected.

The other advantages over compression members were thought to be the following: Economy of material in the lattice-bars. These are short and only one set is required, while two must be used in the other forms of construction. Economy of manufacture, only two rows of rivets being required, whereas four are needed in the other cross-section. Protected position of lattice-bars and consequent freedom from damage during transportation and handling. Possibility of effecting better connections with other members in the design of the structure.

A series of experiments were made to test its efficiency, and prove that the members were safe and consistent. Small columns were used in the experiments, but of the proportions, as near as possible, of those in the structure.

The Z-irons in the latter were 3x5x3 inches in size and 11 of an inch thick, while in the test columns 21/2 x3x21/2-inch Z-irons were used 15 of an inch thick. A table is given with summary of tests, and the expense of testing Nos. I to 6 was borne by the C. M. & St. P. Ry. Co., and Nos. 7 to 15 by this railroad company and Keystone Bridge Company jointly.



The tests were made in the hydraulic testing-machine of the Keystone Bridge Company, at their works in Pittsburg, under the supervision of S. C. Weiskopf, Mem. Am.

The columns were placed, horizontally in the testingmachine, with the lattice bars in a vertical plane, the ends of the column abutting squarely against the castings of the testing-machine without the interposition of shoes. To counteract the tendency of the column to sag from its own weight, an upward pull was caused to be exerted against the middle of the column equal to one-half its own weight. A'l of the columns failed in the direction in which they were theoretically weakest, and in a uniform manner by deflection.

A diagram was presented showing comparison of tests previously made on seven differect forms of columns.

In devising a formula which would satisfy the results of the tests on Z-iron columns for lengths beyond 90 radii, the equation of a straight line was found to answer as well as the equation of a curve, while having the advantage of simplicity. The following is the formula selected: Ultimate strength in pounds per square inch, 46,000 - 125-

for lengths exceeding 90 radii and 35,000 for lengths equal

It has been customary to allow 8,000 pounds per square inch in compression for bridge members of short length, which corresponds to a factor of safety of $\frac{35,000}{8,000} = 4.35$, when taken with reference to the ultimate strength. Although this factor is slightly less than is customary for tension members (for which the factor is about $\frac{46,000}{10,000} = 4.6$), it seems ample, when the fact is considered, that the ratio of elastic limit to allowed strain is the true factor of safety in

the ordinary use of a structure, and that this ratio will be greater for compression members than for tension members on a basis of the above factor. For long compression members which fail by flexure as a whole, the ultimate strength is very little removed from the elastic limit, so that the factor of safety with reference to the elastic limit becomes greater as the length of the member increases. Dividing the constants in the above formula by 4.35 we obtain the following: 10,600 — 28.5 $\frac{1}{2}$. To provide ad-

ditional security for long members, the writer considers it desirable to substitute 30 for 28.5 as the second constant, whence is obtained the following: Allowed strain in pounds per square inch for square ended Z-iron columns

10,600 – 30 $\frac{1}{r}$ for lengths exceeding 90 radii and 8,000 for

lengths equal or less than 90 radii.

GENERAL RESULTS OF COMPRESSION TESTS OF 15 Z-IRON COLUMNS.

Radius of Gyration, Lattice-Bars not Considered, - 2.05.

	i		inches.	ULTII STREM	MATE GTH.	Radius	(Kank-Gord) / 8 .∞∞ / 8	0 — 125.
No. of Statement.	Length of Column	Weight-pounds.	Sectional Area-square inches.	Tctal pounds.	Pounds—square inches.	Ratio of Length to Last of Gyration.	U.t. str. by formula (Rat 1 30,000 + 1 + 36,000	Ult. str. by formula 46,000
1 2		421 441	9.435	347.100 345,800	36,800 34,600	64 64	32,300	
3 2 4 5		570 560	9.489 9.280	328,000 340,000	34,600 36,600	88 88	29,600	35.000
5 6	10' 03/4"	649 754	9.241	312,000 340,600	33,800 33,700	112 112	26.700	32,200
7 8 9	22′0°	805 805 805	9.286 9.286 9.286	285,000 274,300 285,000	30,700 29,500 30,700	129 129 129	24,600	23,900
10 10 11 11 12 12		900 925 930	9.156 9.456 9.516	257,400 265,200 270,400	28.100 28.000 28.400	146 146 146		27:75°
13 13 14 14 15 15		1,025 1,050 1,025	9.375 9.643 9.375	260,000 270,000 258,700	27 700 28,000 27,600	164 164 164	20.600	25.50c

THE NEW ENGLAND WATER-WORKS ASSOCIATION.

The regular quarterly meeting of this association will be held at Young's Hotel, Boston, on Wednesday, December 14, 1887.

The rooms will be open for members' use at 11 o'clock. The Executive Committee will meet at 11:30 o'clock and there will be a general business meeting at 12 o'clock, with lunch at I o'clock. At 2:30 o'clock Prof. Drown, of the Massachusetts Institute of Technology, will read a paper entitled, "The Odor and Color of Surface Waters." Members are invited to be prepared to discuss this topic and to suggest for discussion at future meetings any others which they may deem of interest to the association.

Members are requested to notify R. C. P. Coggeshall, Secretary, New Bedford, of their intention to be present. Members of water boards are also invited to be present.

ENGINEERS' CLUB OF PHILADELPHIA.

THE regular meeting of the club was held November 19, President T. M. Cleemann in the chair, Howard Murphy, Secretary, and 35 members and one visitor present. The secretary presented, for Mr. W. H. Nauman, a paper upon the "Calorimetric Investigation of the Performance of a Compound Engine," embodying considerable tabular data. Mr. J. E. Codman presented a description, illustrated by specimens, etc., of "Cement Tests," showing the effect the shapes of specimens had upon the results. There was some discussion by Mr. A. Marichal. The secretary presented, for Mr. C. H. Haswell, a specimen of cement. The discussion of Mr. C. G. Darrach's paper upon "Boiler Specifications" was continued by Messrs. J. T. Boyd, O. C. Wolf, P. Roberts, Jr., A. Marichal, and the secretary. The secretary also presented a communication thereon from Mr. G. R. Hen-

THE Genic Civile, of November 12, contains a very fully illustrated article descriptive of the Emery testing-machine at the Watertown Arsenal.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Our correspondent reports the holding of a very successful and interesting meeting this week in Philadelphia, about 175 members in attendance. A report of the meeting will appear in our next issue.

MINNEAPOLIS, MINN.—At the meeting of the Engineers' Club of Minnesota, held in Minneapolis last week, the proposed constitution was discussed in detail, and Messrs. Sturtevant, Cappella, Hunter, Turner, and Redfield were appointed a committee to revise the constitution.

A STORAGE-BATTERY OF IDEAS OR BRAIN ACCUMULATOR.

(BILL NYE, in the New York World.)

(BILL NVE, in the New York World.)

MR. EDISON has now perfected, or announces that he is on the road to the perfection of. a machine which I may be pardoned for calling a storage think-tank. This will enable a brainy man to sit at home and, with an electric motor and a perfected phonograph, he can think into a tin dipper or funnel, which will, by the aid of electricity and a new style of foil, record and preserve his ideas on a sheet of soft metal, so that when any one says to him, "A penny for your thoughts," he can go to his valise and give him a piece of his mind. Thus, the man who has such wild and beautiful thoughts in the night and never can hold on to them long enough to turn on the gas and get his writing materials can set this thing by the head of his bed, and, when the poetic thought comes to him in the stilly night, he can think into a hopper, and the genius of Franklin and Edison together will enable him to fire it Franklin and Edison together will enable him to fire it back at his friends in the morning while they eat their pancakes and glucose syrup from Vermont, or he can mail the sheet of tin-foil to absent friends, who may put it into their phonographs and utilize it. In this way the world may harness the gray matter of its best men, and it will be no uncommon thing to see a dozen brainy men tied up in a row in the back office of an intellectual syndicate, dropping pregnant thoughts in a little electric coffee-mill for a

ping pregnant thoughts in a little electric coffee-mill for a couple of hours a day, after which they can put on their coats, draw their pay and go home.

All this will reduce the quantity of exercise, both mental and physical. Two men with good brains could do the thinking for sixty millions of people and feel perfectly fresh and rested the next day. Take four men, we will say, two to do the day thinking and two more to go on deck at night, and see how much time the rest of the world would have to go fishing. A pair of political thinkers could furnish one hundred millions of people with logical conclusions enough to last them through the campaign and put an unbiased opinion into a man's house for less than he now pays for gas. Itst before election you could and put an unbiased opinion into a man's house for less than he now pays for gas. Just before election you could go into your private office, throw in a large dose of campaign whiskey, light a campaign cigar, fasten your buttonhole to the wall by an elastic band, so that there would be a gentle pull on it, and turn the electricity on your mechanical thought-supply. It would save time and money, and the result would be the same that it is now. This would only be the beginning, of course, and after a while every qualified voter who did not feel like exerting himself so much could give his name and proxy to the Salaried Thinker employed by the National Think-Retort and Supply-Works. We talk a great deal about the union of Church and State, but that is not so dangerous, after all, as the mixture of politics and independent thought. Will the coming voter be an automatic, legless, hairless mollusk the coming voter be an automatic, legless, hairless mollusk with an abnormal ear constantly glued to the tube of a big tank full of symmetrical ideas furnished by a National Bureau of Brains in the employ of the party in power?

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York	Manhattan	Metropolitan	Mutual	Munic pal	Krickerbocker	Equitable
	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Cas-Light	Gas-Light
	Company.	Company.	Company.	Company.	Company.	Company.	Company.
November 26	23.62	19.65	22 75	27.32	28.25	26.26	31.84

PERSONAL.

T. W. Fratt has been appointed Chief Engineer for e Wisconsin Central Railroad Company at Milwaukee, Wis.

JAMES S. TROWBRIDGE, of the architectural firm of Buddemeyer, Plympton & Trowbridge, has died of

CHARLES S. STEPHENS, late of the Louis Waefelaer Company, New York City, has been appointed Manager of the Continental Tube Works (Limited), of Pittsburg,

COMMANDER ALEXANDER H. McCormick, Lieut.-Commander George A. Convers, and P. A. Engineer George W. Baird have been appointed a board to consider and report upon the best type of engine and the amount of power required to run all the machinery at the Washington Ordnance Foundry.



^{*} Abstract of paper read at American Society of Civil Engineers, November 16, 1887.

CONTRACTING NEWS DEPARTMENT:

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

GALVESTON, TEX.—Plans, specifications, and estimates are invited, and will be received up to the 14th of December, for the building of Sealy Hospital. For particulars apply to Dr. W. H. Baldinger, Secretary of Committee on Building, Sealy Hospital, Galveston, Tex.

ST. PAUL, MINN.—Architect D. W. Millard, of this city, has been awarded first place in the competition for plans for the new Y. M. C. A. bu lding to be built at the corner of Tenth and Minnesota Streets. Wirth & Haas were awarded second place.

CORSICANA, TFX.—Plans are wanted for the State Orphan Asylum to be built here. No date specified. Address M. Drum, Chairman Building Committee.



For works for which proposals are requested see also the "Proposal Column," pages 1-3-8.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and rel able news for our "Contract ng Intelligence." Information of importance sent to us exclusively, and not eisewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

BUFFALO, N. Y.—The Committee on Sewers has considered new bids for completing the Babcock Street sewer job. Contractor Frank Winter failed in business and has not finished the sewer. His bondsmen refuse to do the work. Three bids have been received for completing the work: W. A. Green, \$45.359; D. W. McConnell, \$52,080; Thomas Dark & Son, \$50,000. City Engineer Krause claims that the bids are excessive, and asked permission to readvertise for bids in Buffalo and other cities. The matter was laid over.

The committee considered three proposals

The committee considered three proposals for ventilating the trunk sewer, submitted several months ago by Mr. Thomas Dark, Sr., by the McAndrews Sanitary Company, and by Benson & Stilwell. Mr. Dark's plan involves an expenditure of about \$15,000, that of the McAndrews Company about \$35,000, and that of Benson & Stilwell about \$10,000. The estimated cost of natural gas is \$600 per year. The committee resolved to report in favor of Mr. Dark's plan.

FOSTORIA, O.—A few days ago the vote on water-works occurred, the result being yes, 526: no, 7. The works are to be constructed by an Eastern firm, the city reserving the privilege of buying them at the end of five years. Work on the construction will be begun at the earliest possible moment and ten miles of mains will be put down.

Framingham, Mass.—The question of a proper and efficient system of sewerage continues to occupy the attention of the selectmen, who were appointed as a special committee on drainage at a meeting held last August. S. C. Herald, an engineer of this town, has submitted his report as directed by the committee, of the estimated cost in detail of such a system as is desired, and, according to it, the system complete will cost \$140.059.15. The report has been approved by the special committee, and the matter is now in the hands of the selectmen. Important developments are expected soon.

DEVIL'S LAKE, DAK.—The City Council resolved to call an election for the purpose of voting on the question of bonding the city in the sum of \$12,000 to sink an artesian well and maintain a system of water-supply, also to build a city hall.

DE LEON SPRINGS, FI.A.—Water-works will be established here as soon as E. F. Barney can fix details.

HENDERSON, N. C.—Water-works are contemplated here MOORHEAD, MINN.—A contract has been let for a 5-inch hole, 1,500 feet deep, artesian well, for \$7,500.

FAULKTON, DAK.—Contract for artesian well let to Swan & Co. Work to commence December 1.

ALLEGHENY, PA.—The contract for the erection of a water-tank has been awarded to Messrs. Sailor, Briggs & Lyons at \$2,283.50.

HENDERSONVILLE, N. C.—January 2 is the day when the water-works question will be decided by the people at the polls.

BONHAM. Tex.—At a meeting of the Council held November 23 the issuance of \$50,000 worth of bonds was ordered for waterworks. The water will be obtained by a system of artesian gang-wells, and work on the wells will begin at once.

ST. Andrews, New Brunswick.—Our correspondent says: "The officials of this city desire to communicate with water-works contractors concerning a project to establish water works here. The supply is to come from a lake about four miles distant and eighty feet above the level of the town. Address T. McGrath, 120 Broadway, New York City, Room 36, Seventh Floor."

COLUMBUS, O.—The water-works trustees have decided to throw out the bids for the construction of a 15.000,000 gallon pumping engine and have ordered the superintendent to readvertise for bids up to December 8, as the bids received November I do not fill the requirements.

SALISBURY, MD.—There has been considerable controversy over the franchise granted to J. A. Cloud & Co., of Philadelphia, by the town authorities to place water-works here. Some of the lawyers of the town dispute the commissioners' authority to grant such a franchise, as the town charter, it is claimed, does not invest them with the authority. Several local capitalists were considering the question of erecting the works themselves, with the idea that the franchise granted to Cloud & Co. would be abrogated. A letter, however, has just been received from Mr. J. A. Cloud by the town commissioners, in which he says that it is his firm's purpose to build the works and has already taken preliminary steps in that direction. He adds that he will hold the town of Salisbury responsible if works are erected by other parties before the terms of his franchise expire. The matter is now in the hands of the trustees.

MANKATO, MINN.—Our correspondent writes: "This city has about completed a reservoir of 1,000.000 gallons capacity on the hill near the city with an elevation of 230 feet above the business part of the city. The same is connected with the water-mains by 16-inch pipe. Water to be forced into reservoir from flowing well at the foot of hill. We have also commenced a system of sewerage and will expend about \$15,000 this season. Sewer ranging from brick sewer 36x54-inch to 10-inch pipe sewer, together with 6-inch house connections."

HYDE PARK, MASS.--Our correspondent informs us that nothing has been done towards establishing water-works here.

Grand Rapids, Mich.—Our correspondent writes: "It is impossible to state at this time what we will do in the way of improvement of our water works, as the whole thing depends upon the result of the vote on the proposition to raise money for this work. If it fails to carry nothing can be done. December 6 is set as the time for the election."

ROCHESTER, PA.—In answer to an inquiry concerning water-works construction here our correspondent writes: "We have obtained charter, made contract with borough councils to supply sixty fire hydrants for term of thirty years at price or sum of \$2,750 per annum, are now making contracts with manufacturers and other consumers, and expect to let contract for construction of our works early in the year 1888. Rising main will be twelve or sixteen inches. Reservoir elevation 350 feet above level of Ohio River, from which water will be pumped by two compound pumpingengines (vertical) of a capacity of about 1,500,000 gallons each per day. Will lay six or eight miles pipe, mostly from 6 to 12 inch."

MONTGOMERY, ALA.—In all probability there will be considerable sewerage work here shortly. A project to that end is now being agitated.

ORONO, ME.—A meeting was held in Orono recently and preliminary steps-were taken for the organization of a water company, under the charter granted by the last Legislature. A committee was chosen to make estimates of the cost and consider the feasibility of putting in the works next year.

KANSAS CITY, Mo.—The National Water-Works Company will construct two water-towers, one at Quindars and the other on the bluffs; to be built of double iron sheeting, and to cost \$25,000.

NORFOLK, VA.—This city is at present discussing two projects, one as to a system of filtering their present supply of water, and another of erecting a new water-works plant. Propositions have been received from several concerns, suggesting ideas and asking for authority to proceed with their schemes. Nothing definite has been done as yet, though it is probable that a new plant will be established, with a supply from driven wells. The Mayor of the city favors this last project.

WOODSTOCK, VT.—The construction of the reservoir and laying the pipes of the Woodstock Aqueduct Company has just been completed. The reservoir is about two miles west of and is 260 feet higher than the village. The pipes are all cast iron, the larger main being eight inches, and the reservoir contains 2,500,000 gallons. The company was incorporated in 1880 and the capital is \$30,000.

OMAHA, 'NEB.—The Omaha Water-Works Company has just contracted for one of the new Gaskill pumps, manufactured at Lockport, N. Y. This pump is an identical pattern of the one just placed at Buffalo, and has a capacity of 14,000,000 gallons per day, with all the modern improvements and a guaranteed duty of 100,000,000 foot pounds. It weights 600 tons, and its transportation here will require a freight train of twenty cars or more. The foundations for and the erection of the pump wi'l cost over\$100,000, and the contract provides for its placement at the new plant at Florence and in readiness for operation, by the 1st day of June. 1888. It will be the second largest pump in the United States, and is only another evidence of the magnitude and thoroughness of the plans for the new waterworks plant. When finished it will be one of the most effective and complete systems in the world.

JERSEY CITY.—John F. Ward, of this city, has contracted to lay 1,250 feet of 12-inch cast-iron water-pipe across Burrad Inlet, at Vancouver, British Columbia, for \$12,000. He has also contracted to lay over 6,000 feet of 12-inch cast-iron water-pipe across the Guyas River, at Guayaquil, Ecuador, for \$43,000.

ATHOL, MASS.—Concerning a report that water-works were to be established here, our correspondent says: "Our town has an established water-works, all complete, and has had for the past 10 or 12 years."

GALION,O.—Our correspondent writes about water-works matters here: "Our city is supplied with water by a system similar to the Holly, with stand-pipe attached; source of supply, a driven well, 20 feet diameter, with cluster of driven wells to augment it; owned by a local company; projected and nearly completed by "Starr," from near Philadelphia or New Jersey, do not recollect which; water-works effectual during this summer's severe drought."

Mt. Vernon, N. Y.—Concerning a rumor that water-works were to be erected here, our correspondent writes as follows: "The Mt. Vernon Water Company has a system of water-works in operation; I know of no other in contemplation."

PINE BLUFF, ARK.—Our correspondent writes concerning water-works matters at this place: "The contract for water-works in this city has been awarded to the St. Louis Water, Light, and Power Company, The works are now in process of erection and will probably be completed by the 1st of March next."

KALVESTA, KAN. — Our correspondent writes: "Our well is on the town site, but the distance to the farthest point where we intend to force the water is a little over one mile. We intend to elevate the tank at the well so as to give sufficient pressure to force the water to any point in town. We will use a three-way anti-freezing pump and a 12-foot Star windmill."

KNOXVILLE, IA.—Our correspondent writes: "We are putting in a stand-pipe 120 feet high by 12 feet in circumference; laying 12, 8, and 4 inch mains, and a pumping engine of 750,—000 gallons capacity."

BRISTOL, TENN. — Our correspondent writes: "Our corporation has employed an engineer and he is now engaged surveying several routes to different springs or water-courses and will soon make his report. I think some action will be taken with a view of establishing water-works for supplying Bristol, Tenn., and Goodson, Va., with water."

JERSEYVILLE, ILL.—Our correspondent writes: "We are having an artesian well bored for the purpose of supplying our city with water. The intention is to bore to the depth of at least 2,000 fect, unless a stream of water large enough is found to guarantee a good supply before reaching that depth."

PITTSFIELD, ILL. — Our correspondent writes in answer to an inquiry about waterworks matters here: "We have got the watertower built and are now waiting for the tank, which according to contract should be here and in position. It will be 105 feet high when complete. Mains have just been laid in front of all business houses. Water is supplied from a large well, and bids are being now received for digging an artesian well from 1,500 to 2,000 feet deep. Pavements of flagging of Cleveland stone are being laid in front of all business houses. All work is being done under superintendence of the Town Trustees."

JEFFERSONVILLE, KY.—It is reported that a contract has been made with Messrs. S. R. Bullock & Co., of New York City, to erect water-works here. Work will begin at once.

WALTHAM, MASS.— The Sewerage and Drainage Commission will prepare plans and estimates for a sewerage system.

St. Paul, Minn.—The Board of Public Works has rejected all bids for building sewer on Walnut Street as too high.

TIOGA, PA.—The Tioga Water Co. has been incorporated. Capital stock, \$15,000. T. A. Wickham, E. G. Schufflin, and others, incorporators.

BURNET, TEX.—Our correspondent writes: "The City Council of Burnet, on petition of the citizens, has ordered the sinking of an artesian well and appointed a committee to solicit bids and make contracts. City wants a well flowing a continuous stream at least six inches in diameter, and, if possible, to rise 25 or 30 feet above the surface, durably piped with heavy iron piping. We do not know the depth, but think that the water can be obtained at 500 feet, but the city wants the water if we have to go 1,000 feet or more."

WARREN, MASS.—Our correspondent answers an inquiry about water-works here as follows: "There are no new arrangements for water-works, except one by a number of individuals who have built an iron reservoir on a hill, the supply for which is pumped from the river by water-power from one of the factories."

ALLENTOWN, PA.—Concerning water-works matters here our correspondent writes: "There has been about 2,700 feet of 20-inch pipe laid, which was furnished by R. D. Wood & Co., of Philadelphia. The foundation for the pumps is laid, which are built by the Knowles Manufacturing Co. The foundation for stand-pipe is laid. It is to be erected by Tippett & Wood, of Phillipsburg, N. J. The pumps were to be finished by November 1 and staud-pipe by December 1, but neither have made their appearance."

CLARKSBURG, W. VA.—John W. Hill, of Cincinnati, O., is consulting engineer for water-works to be erected here.



GALVESTON. TEX.-Our correspondent 'The recent amendment to the city charter empowers the city to construct waterworks and sewerage, allowing \$450,000 to be raised by bonds for that purpose. Recent periments by boring shows that water can Recent ex. secured at from 800 to 900 feet deep. Two wells, bored by the hydraulic-jet process, chiefly through sand yields over 100,000 gallons each every twenty four hours. A number of these wells are expected to give in the aggregate all the water required. A Board of Water-Supply Commissioners has been appointed and Colonel J. D. Cook, C. E., of Toledo, O., has been secured as consulting and supervising engineer. He has just visited this city and will shortly report the most ad-visable plan to adopt. The amount allowed by charter (\$450,000) will about secure a water-supply, and the sewerage question must remain in abeyance till the reconvention of the next Legislature."

PARKSIDE, N. V .- A system of sewerage will be established here next spring.

HILLSBORO, ILL.-W. R. Coates, C. E. of Kalamazoo, has begun a survey of the city preparatory to drafting plans and specifications for a system of water-works, costing \$25,000.

ITHACA, MICH.--This place will probably establish a system of water-works before long.

The question is now being agitated.

ALTON, Mo.—A special election will be held here shortly to determine the question of water-works. A committee has been appointed to arrange for the election.

BROOKLYN, N. Y .- The question of a better water-supply for this city is again being agitated, and the Ramapo Water Company has renewed its offer made several months ago. The communication from the Ramapo Water Company was presented to the Board of Aldermen, who referred it to the Water and Drainage Committee.

BLOCK ISLAND, R. I .- A water-works system will be established here soon.

SANTA MONICA, CAL-It is reported that Senator Jones, now here, will build water-works for this resort. Water will be brought from San Vicente Springs, over three miles, to an immense reservoir. The works will cost \$40,000.

NEW ORLEANS, LA .- New machinery is to be added to the water-works here.

STURGIS, MICH.—A system of water-works is wanted here.

SEDALIA, Mo.- An ordinance has been passed providing for 13,000 feet of water-mains and twenty-five hydrants.

LAFAYETTE, IND.-W. R. Coats Kalamazoo, Mich., has finished plans for the improvement of the water-works system here.

GADSDEN, ALA.-A sewerage system is anticipated here.

CENTRALIA, ILL.—The committee appointed at the last meeting of the City Council to interest themselves in securing a suitable sys tem of water-works for this city met recently and authorized the Mayor to request T. C. Morgan, of Chicago, a civil engineer, to visit Centralia for the purpose of examining the water supply and mapping out a system of works suitable for this city.

TAUNTON, MASS.—It is reported that the State Board of Health has advised the city of Brockton to dispose of its sewage by filtration.

SACRAMENTO, CAL.-A company has been formed to take 100,000 inches of water from Dry Creek, Amador County, for irrigation in Sacramento and Fresno Counties.

WINDSOR LOCKS, CONN.—At a recent meeting of the Windsor Locks Water Company plans were discussed and estimates given for the purpose of supplying the town with water. Edward D. Coogan and Henry C. Douglass were appointed a committee to examine such plans, etc., as were made and to procure estimates for necessary work in connection with the project. The question will be determined at a meeting to be held at an early date.

PROVIDENCE, R. I.--Our correspondent PROVIDE.SCE, K. 1.—Our correspondent writes: "We are to build a new pumping station, No. 3, and lay additional force mains. There have been no steps taken as yer; shall commence in the spring. Such material as will be needed will be purchased and detained this winter.

READING, Pa .- This place is discussing the question of increasing the water-supply

TORONTO, CAN. -It is probable that there will be considerable sewer-work here before

CHICAGO, ILL.--Answering a question in regard to the Oak Park Water, Gas and Electric Co. our correspondent says: "This plant was started some four or five years ago by Mr. James W. Scoville, of Oak Point, who placed in the earth, in the shape of a pond, a reservoir covering over two acres of ground. Following this he erected a stand-pipe, 105 feet high, put in 100 horse-power engine of two boilers, and dug one artesian well some 2.000 feet deep of 5-inch capacity. In Sep-tember last Scoville was bought out by the Cicero Water, Gas and Electric Co., who paid \$65,000 for the well, reservoir, engine house, real estate, etc., connected therewith. The latter company has now 32,000 to 33,000 feet of water-pipe laid, and it is the intention of the company to put in ten miles more pipe during next season. The same company also during next season. The same company also expects to supply the villages of Oak Park, Ridgeland, Austin, and Moreland with water. One or two more artesian wells will be sunk this winter."

BRIDGES.

BORDENTOWN, N. J.—The Trenton Iron Co., of Trenton, has been awarded the contract for the construction of a bridge here.

St. Louis, Mo .- The King Iron Bridge and Manufacturing Co., of Cleveland, O., has been awarded the contract for the construction of a bridge on Grand Avenue. Cost, \$225,000.

DUBUQUE, IOWA .- Mr. Spalding, of this city, has received the contract to erect a highway bridge for the county at Zollicoffer's, He will take down two spans of the D. & E. D Company's bridge across Seventh Street slough, which weigh 60,000 pounds, and slough, which weigh 60,000 pounds, and transport the material to Zollicoffer's in wagons. The area beneath the two spans to be removed he will fill to the grade of the railroad track.

BLACK RIVER FALLS, WIS .- The county of Jackson and the town of Albion have let a contract with Ward & Keepers, of Clinton, Iowa, for the erection of an iron bridge across Perry's Creek about three miles south of this city. The work is to be completed in three months.

Oshkosh, Wis.—This city will expend \$20,000 for a new iron bridge across the Fox River.

FINDLAY, O .--The Board of Commissioners of Hancock County are considering a proposition to build a road and foot-bridge across the Blanchard, and will doubtless order the construction of the same at their December meeting. The cost of the bridge will not be less than \$60,000.

GRAND FORKS, DAK. T.—Resolutions were passed at a recent meeting of the Council to petition the next Congress for leave to construct two iron bridges across the Red River at this place, and also to bond the city in \$50,000 to build the same.

PINEVILLE, KY, -Our correspondent writes; Two iron bridges are to be built across the umberland River at this place. The bridges Cumberland River at this place. are to be built by the county. Also new brick and stone court house and jail to cost \$20,000, and a large new hotel. All to be let soon and work to be pushed as rapidly as possible this winter. We will be glad to answer all inquiries. Address the Bridge or Court-House Commissioners, or James S. Ray, President Pineville Land and Iron Co., Pineville, Ky."

SEYMOUR, IND. -Our correspondent writes concerning bridge matters here: "We have built one bridge this year and have one on hand at present, at a cost of about \$18,000; will build one next year.

TER, CAL. — Our correspondent The Board of Supervisors of this HOLLISTER, county has received bids for constructing a bridge across the San Benito River. The contract has been given the Pacific Bridge Co., of San Francisco, for \$18,500.

MECHANICVILLE, N. Y. - The \$20 000 worth of stock issued to build the new across the Hudson River at this place has all been sold, and as soon as the plans are com-pleted bids will be advertised for. President Smith and Treasurer Moore are pushing matters to start it at once.

MEMPHIS, TENN .- The negotiations between the Ford syndicate, which possesses a charter for a bridge over the Mississippi River at this point, and the railroads touching here. broken off. The latter declined to buy the Ford franchise on account of the restrictions of charter, and because they did not consider it worth the price demanded—\$500,000. The Ford people now announce that they will build the bridge with the aid of the Union Bridge Company of New York, and promise to begin work within a month.

OMAHA. NEB.—It is reported that a bridge is to be erected across the Missouri for the benefit of the Chicago, Milwaukee and St. Paul Road. General Superintendent Clark. of the above road, can give information.

TALCOTTVILLE, CONN. - A new iron bridge to be be built at once over the Hockanum River in Talcottville.

BLACK RIVER FALLS, WIS .- Town of Albion and County of Jackson have contracted with Ward & Keepers, Clinton, Iowa, for construction of iron bridge.

FORT WAYNE, IND .- The County Comissioners have advertised for new proposals for building an iron bridge over St. Mary's River.

MINNEAPOLIS, MINN.—A new bridge is to be erected over the Manitoba and St Louis tracks at Lyndale Avenue in this city, at a cost of \$40,000. Alderman Cloutier can give information.

ST. PAUL, MINN.—Bonds for \$50,000 for building the Colorado Street bridge have been authorized

The City Council has rejected all bids for hot-water heating the foundling home and annex, and ordered a readvertisement for bids.

SPARTA, N. C .- Four bridges are to be erected by the Commissioners of Allegheny County.

GAS AND ELECTRIC-LIGHTING.

MANCELONA, MICH .- The electric light is to be put in here shortly.

WASHINGTON, KAN. — The Washington Electric-Light Co. has been granted the ex-- The Washington clusive privilege of operating electric lights here for 21 years.

BRYAN, O .- Another gas well has been shot with 96 quarts of nitro-glycerine, increasing the flow of gas to 2,000,000 feet per second. The result of this operation will settle the question of laying pipe mains into the city limits, and eventually the use of gas both as fuel and light will be adopted. Meanwhile, well No. 1, sunk one year ago, continues to flow oil at intervals of three or four days."

LAWRENCE, MASS .- By authority of the Gas Commissioners the local gas company will purchase a plant for electric lighting.

GAINESVILLE, FLA.-W. J. Winegar, of Palatka, has purchased a site to build gas-works, and will begin work at once.

CRETE, NEB.—The incandes ent system electric lights recently put in operation in this city is said to have proved a costly failure

HENDERSON, N. C.-Gas-works will probably be established here. Address the Mayor.

GOLDSBORO, N. C .- An electric-light plant is to be erected here. H. A. DeKay is in charge of the scheme.

CARROLLTON, KY.—Gas-works are to be established here. H. M. Winslow can give information.

GLENS FALLS, N. Y.—The Electric Light Committee of South Glens Falls has signed the contract with the Thomson-Houston Com pany, and the lights will soon be put in.

LEICESTER, MASS .-- It is reported that a stock company has been formed here to introduce electric-lights into several of the many

MANCHESTER, VA.—The Manchester Fuel, Power and Lighting Co. will erect a plant here.

ASHEVILLE, N. C .- Additional machinery will be placed at the local electric-light works to enlarge their incandescent plant.

EAST PORTLAND, ORE.-H. Hoyme can give information concerning an electric-light plant to be established here

OXFORD, N. C.—An electric-light plant is wanted here. The Mayor can give informa-

DUNDEE, MICH .- This village has granted to the Dundee Fuel Gas Company for thirty years the exclusive privilege of laying pipes for conducting oil, gas, or mineral water, and the company agrees to have laid 5,000 feet of pipe within five years.

CARLINVILLE, ILL.—This place is to have an electric light plant, with a capacity of filty arc lights of 2,000 candle power.

GRAND LEDGE. MICH .- An electric-light plant here is assured.

LIVERMORE, CAL.—The Town Council has granted to Thomas Varney, President of the Bank of Livermore, and others, a franchise for the erection of an electric-light plant, and it is stated by the projectors that work will be begun within a few weeks.

OAKLAND, ME .- The subject of lighting the streets of this place by electricity is at present engaging the attention of the citizens.

POMONA, CAL.—This place is to be lighted with gas soon.

HASTINGS. MINN. - Thomson-Houston Electric-Light Co., of St. Paul, has franchise to put in plant here.

GRAND FORKS, DAK .- A Griggs is putting in a \$75,000 gas plant.

FORT WAYNE, IND.—Our correspondent writes: The Jenney Electric Light and Power Company has purchased what is known as the "Feeder Canal" for \$67,000, and will utilize its water power to operate the city plant.

CHICAGO, ILL.-A letter received from the Vice-President of the Cicero Water. Gas, and Electric Company, recently organized in this city, for the purpose of furnishing light, water, etc., for the villages of Oak Park, Ridgeland, Austin, and Moreland, says: "We have not, as yet, decided whether we will use electricity or gas for lighting purposes. We will determine that during the winter.'

STREET WORK AND PAVING.

ST. PAUL, MINN., Board of Public Works as awarded contract for grading Third, has awarded contract for grading Third, Fourth, and Canal Streets to J. D. Moran at \$25,000.

RAILROADS, CANALS, ETC.

GREENVILLE, TEX.-Charters have been granted two companies to build street railways here.

RALEIGII, N. C.-P. Lineham & Co., of this city, have been awarded the contract for the construction of a line of railway for the Durham and Northern Railway Company.

MORRISTOWN, TENN.-A company will be organized soon to build a street railroad. O. C. King can give information.

THE Minneapolis, Sault Ste. Marie and Atlantic Railroad will construct a line from Rhinelander to Ashton.

KANSAS CITY, Mo.—The City Council has granted a franchise to the Holmes Street Cable Car Company to construct a cable railway in this city, over ten miles in length. It will be necessary in constructing this road to build a necessary in constructing this road to build a viaduct of iron trestle nearly three-fourths of a mile long and 75 feet high. A large iron bridge will also be erected across Rock Creek. Work is expected to begin shortly.

FORT SCOTT, KAN .- The Missouri Pacific Railroad will erect an immense dining building here.

ASHLAND, KAN .- A company has been formed here to construct and operate a street railway.

BIDS OPENED.

CHICAGO, ILL .- Synopsis of bids for buildng breakwater around old water-works crib" in Lake Michigan to secure greater protection against ice:

rotection against ice:
Fitz-Simons & Connell, Chicago, \$119,000.
H. G. Herr, Milwaukee, \$119,000.
Chicago Bridge & Deck Co., \$129,000.
Fitz-Simons & Connell received the con-

BROOKLYN, N. Y.—The contract for two additional boilers at St. Johnland has been awarded to Charles Collins for \$5,350.

DENVER, COL.—Synopsis of bids for the furnishing of material and the construction and erection of a bridge across the Platte River, opened November 16 by the County Commissioners of Arapahoe County, Col.:



T. E. Baker, Fort Morgan, Col., \$10.63 per lineal foot

W. E. Edom, Denver, Col., \$1,540 for entire work R. Jackson, Denver, Col., \$1,345 for entire

W. C. Houghton, Denver, Col., \$1,359 for entire work.

entire work.
Insley, Shird & Tullock, Denver, Col., \$7.47 per lineal foot.
The Bullen Bridge Company, Denver, Col., \$6.74 per lineal foot.
Mr. Severns, Denver. Col., \$5.68 per lineal

Thomas O. Brown, Denver, Col., \$1,175 for entire work

FINDLAY, O .- Synopsis of bids for the construction of water-works, opened in this city, November 28, by the Water-Works Trustees, John W. Hill, Civil Engineer:

Huston & Freeman, Cinculnari, O. W. H. Campfield, Findlay, O	Biduars.
\$56,709.36 81.331.05 88 934.75 98,023.72	Impounding Reservoir.
\$6,907.50 7,737.75 7,845.00 5,166.70 4,362.60	Storm-Water Sewer.
9.800	Pumping Station and Chimney.
\$9,348.06 9,311.22	Masonry Dam.
\$1°.612.87 37.473.67 16,738.47	Channel Improvement.
\$8.647.56 6.379.92	Pumping-Well and Engine- House Foundations,
	Gate Chamber, Howe Foot Bridge, and Shore Pile.
\$1,116.83 \$11.876 38 \$890.21 \$ 1,275.61 10.669.04 2.081.53 24,436.23	Gravel Filter Embankment.
\$800.21 2.081.53	Improvement of Pumping Station, Grounds, Suction Conduits.
\$117,142 63	Тотац.

MILWAUKEE. WIS. - Synopsis of bids for lighting streets in the suburbs, not lighted by gas, opened November 19 by the Board of Public Works. The Wheeler Reflector Company offered to put up lamps at \$16.26 per light on the old poles and \$17,60 on new poles. The Northwestern Globe Gas-Light Company would furnish oil lamps at \$15.30, reflectors at \$16.80 on old poles and \$20 where new poles are used. The Badger Illuminating Company offered to erect and maintain electric lights at \$190 per year where overhead wires could be used; \$215 where underground wires are necessary and the number of lamps less than 25. For from 25 to 50 lamps, underground wires, they wanted \$2.05 per lamp. Bernhard Fritche put in a bid for oil lamps in the Eleventh Ward at \$12 per light, lighting streets in the suburbs, not lighted by lamp. Bernhard Fritche put in a bid for oil lamps in the Eleventh Ward at \$12 per light, and in the Fourteenth at \$13 per lamp. Wm. Klein offered to light the Ninth Ward with oil at \$14 90 per light. Fred. Luening bid \$12.13 per lamp for oil in the Eighth Ward and John Widerski \$14 for oil in the Fourteenth Ward. The Sun Vapor Light and Stove Company offered to light all of the wards for \$17.20 per lamp, and also put in a separate bid for each ward ranging from \$20 to \$22. The bids will be sent to the council, which will award the contract. The contract is for three years from the 1st of October, is for three years from the 1st of October,

NEW YORK CITY.—The Department of Charities and Correction was to have opened bids November 29 for a steam pump, boilerhouse, etc., three pavilions, etc., steam boiler and steam apparatus, for the farm at Central Islip and for Randall's Island, but the opening has been postponed and the bids will be readvertised.

CHICAGO, ILL.—Synopsis of bids for build-CHICAGO, ILL.—Synopsis of bids for building a viaduct at the west approach to Jackson Street, to span the C., B. & Q., the P., F. W. & C., and the C. & A. Railroads: Pittsburg Bridge Co., \$114.800; Detroit Bridge and Iron Works, \$95,500; Keystone Bridge Co., Pittsburg, \$94,610; W. G. Coolidge & Co., Chicago, \$94,555; King Iron and Bridge Co., Buffalo, \$92,404; and for part of work only, Chicago Forge and Bridge Co., \$40,725; A. Gottlieb & Co., Chicago, \$89,840. The contract was awarded to last-named bidders.

TORONTO, CANADA.—Synopsis of bids for water-meters opened November 14 by James B. Boustead, Chairman Water Committee:

(Crown) National Meter Co. (Crown).	(Worthingto:)	(Crown pattern)	ton pattern), Toronto	H. R. Worthington \$1,594.00 \$1,240.00 \$560.00 \$293.00 \$637.00 \$1,980 \$166.00	BIDDENS.	
13 00 13.50	13.95	13.65	12.80	\$1,594.00	%-inch. 1∞0.	
20.00	20.00	21.60	22.40	\$1,240.00	36-inch. 3-inch. 3-inch. 4-inch. Deposit. 100. 25. 6. 6. 6. Deposit.	
30.∞	24.75	:	29.60	\$₺60.∞	1-inch. 25.	
•	24.75 40.75 80.30	<u>:</u> :	48.8₀	\$293.00	a-inch. 6.	
75.00 150.00	80.30	: : :	97 82	\$ 637.∞	3-inch. 6.	
300	295	<u>:</u>	276	\$1.980	4-inch. 6.	•
57.50 159.37	150.00		145.00	\$:66.00	Deposit.	1

In connection with the above meters the committee submit the following report of the Superintendent:

TORONTO, November 16, 1887. "To the Chairman and Members of the Com-mittee on Water Works:

GENTLEMEN-In reference to the tenders for the water-meters required by the Department, I would respectfully recommend as fol-

"For the %-inch and 3/-inch meters what is known as the 'Crown meter,' and for the I-inch, 2-inch, and 3-inch what is known as the 'Worthington meter'; these meters have both been thoroughly tested by the Depart-

ment and found very satisfactory.
"I would also recommend theacceptance of their respective makers—namely, for the Crown meter, the National Meter Company, of New York, and for the Worthington meter, H. R. Worthington, of New York, for the reason that these meters have given better satisfaction than those made by the Canadian manufacturers of the same pattern, which is accounted for by the fact that the most deliaccounted for by the fact that the most deli-cate working parts are made of a composition, the secret of which the Canadian manufac-turers are not in possession of. This applies more especially to those of the Worthington pattern. I don't think any meters of the Crown pattern have been made in the city, so that it would be in the light of an experiment with this meter, and as the working parts of the Crown meter are also made of a composition, I think it would be advisable to procure these meters from the patentees and original makers.

"All of which is respectfully submitted.

"WILLIAM HAMILTON,

"Superintendent."

Your committee, therefore, begs to recom-nend that, in accordance with the report of the Superintendent, tender No. 5 be accepted for 100 meters, of \(\frac{1}{2}\)-inch size, at \(\frac{1}{2}\)1.50, and 50 meters, \(\frac{1}{2}\)-inch size, at \(\frac{1}{2}\)2 50, both sizes of the Crown pattern. Also that tender No. 1 be accepted for 25 one-inch meters at \$860; 6 2-inch meters at \$293, and 6 3-inch meters at \$637, of the Worthington pattern.
Report adopted in Council.

St. Louis, Mo.—Synopsis of bids for 100 fire-plugs, 100-valve box-raisers, and 100 stop-valve boxes, opened November 22 by D. P. Rowland, Commissioner W. W. Supplies:

Bidders.	roo	100 valve	too stop-
	fire-plugs.	box-raisers.	valve-boxes.
J. P. Evans, St. Louis	\$4.10	37C.	\$3.25
John Thornton, St. Louis	3.70	30C.	3.25

There being a tie in the valve-boxes, it was awarded by lot to John Thornton, he being the successful bidder.

GOVERNMENT WORK.

DALLAS, TEX.—Synopsis of bids for iron fencing and lathing, plastering, joining, wood flooring, glass, hardware, painting and polishing, marble tiles and mantels, cement floor, opened November 23 by the Supervising Architect of the Treasury Department: chitect of the Treasury Department:

Doerzbach & Decker McNeil Bros John O'Connor	A. Brownlee James De Costa Davidson & Son Robert Mitchell Fur. Co. John Meyers & Son John Meyers &	Ripheks	
	923,551.5	Yellow Pine for Joining.	
24.476.00 31.233.00 20,280.00	\$33,551.20 15,296.00 18,968.00	Cypress for Joining.	
31,000.CO 31,043.00 21.280.00	\$24.551.00 IOC. 23,655.00 IOC. 15,295.00 IOC. 19,130.38 ISC.	White Pine for Joining.	
	120.	Additional wood floor per sq. ft.	t

SYRACUSE, N. Y .- Synopsis of bids for marble floor, tiling and wainscoting, and one marbleized mantel for Post-Office, etc., opened November 19 by the Supervising Architect of the Treasury Department:

BIDDERS.	Tiling.	Wainscoting	Mantel.	Total.
Pickel Marble and Granite Co., \$1,174.92 \$3,156.70	\$1,174.92		\$100	\$100 \$4 501.28
Davidson & Sons	1,200.00	3,150.00	100	4.450.00
herman & Flavin	950.00	3,265.78	100	4,315.78
Robert C. Fisher	2,302.00	2,342.00	100	4.744.00
E. Fritsch	1,225.00	2,075.00	ž	3.340.00
Esser & Alden	1,425 00	2,625.00	8	4.150.00

TOMPKINSVILLE, N. Y.—Synopsis of bids for 2,000 yards double conducting cable opened Ly A. F. K. Benham, Commodore, U. S. Navy, Lighthouse Inspector, November 30: India Rubber and Gutta-Percha Co., Front Street, City. 49½ cents per foot; The Bishop Gutta-Percha Co., East Twenty-fifth Street, \$1,140; The Okonite Co., 13 Park Row, \$1,080; Standard Underground Cable Co., Cortlandt Street, \$2,040; E. B. Mc-Clees, 16 Dey Street, \$1,200.

WASHINGTON, D. C.—Synopsis of bids for furnishing terra-cotta pipes and bends for the heating and ventilating system of the Congressional Library building, opened by the commission for construction November 21: Wight Fire-proofing Company, Chicago, Ill., \$6,347.50; G. W. Rader & Co., New York. \$10,719; Trenton Terra Cotta Company, Trenton, N. J., \$7,051.

CHELSEA, MASS.—Synopsis of bids for boiler-house complete, with pipe connections to old system, Marine Hospital, opened No-vember 22 by the Supervising Architect of

the Treasury:
L. E. Miller, \$9,945.
James Barrett, \$10.580.
Albert B. Franklin, \$10,787.
Walworth Mfg. Co., \$9,652.

ERIE, PA.—Synopsis of bids for Court-House, etc., opened November 21 by the Supervising Architect of the Treasury Department for iron furring and lathing, plastering, joinery, wood flooring, glass, hardware, painting, polishing, and marble work:

Doerzbach & Decker Henry Schrenk Davidson & Sons Pickel Marble and Granite Co and if P ckel marble be used. I. H. Coster McNeil & Bro. William Russel John O'Connor John Moorenor John Moores & Son Jonn Meyers & Son	BIDDERS.
\$58,887 46,995 48.500 45,800 42,749 72,074 62,650 62,650 62,800 47,991 48,797 49,743 55,000	Amount for White oak.
\$60.387 47.395 49.000 75.67 63,405 02.800 48,893 49,907 50,706 56,000	Amount for Cherry.
62,887 51,995 50,040 80.567 65,148 68.000 40,844 53,243 59,000	Amount for Mahogany.
45c. 15c. 16c. 16c. 16c. 16c. 16c. 16c. 16c. 16	Additional flooring per square foot,

PROPOSALS.

(Continued from page 8.)

Proposals for Tiling.

Proposals for Tiling.

OPFICE OF BUILDING FOR
STATE, WAR, AND NAVY DEPARTMENTS,
WASHINGTON, D. C., December 3, 1887.

Sealed proposals for furnishing, delivering, and laying in place complete the plain and encaustic tiling of the library floor in the west wing of the building for State, War, and Navy Departments, in this city, will be received at this office u.t. 12 M. on WEDNES DAY.
THE IWENTY-FIRST DAY OF DECEMBER, 1887, and opened immediately thereafter in presence of bidders.

Specifications, general instructions to bidders, and blank forms of proposal will be furnished on application to this office.

THOS. LINCOLN CASEY,
Colonel, Corps of Engineers

COUNTY JAIL.—Proposals are wanted for the

COUNTY IAIL.—Proposals are wanted for the erection of a County jail at Charleston, S. C. Until December 16. Address Edwin R. White.

ENGINE-HOUSE.—Bids wanted at Baltimore, Md., until December 10. Building to be 25x110 feet, two stories. Address Theodore Oster, Building Inspector.

SCHOOL-HOUSE.—Proposals wanted for building school-house at Brooklyn, N. Y., until December 6. Address William Harkness, Chairman Board of Educa-

DREDGING.—No bids were received for dredging in Mott Haven Canal by James C. Hayles, President of the New York City Board of Health, up to December 1, and the date has been changed to January 1, 1888.

BRIDGE ABUTMENTS.—Construction of abutments of a wrought iron bridge at Atlanta, Ga. No date specified. Address M. S. Belknap, Atlanta, Ga.

PUMPING-ENGINE.—Proposals wanted at Columbus, O., 10r Our 15,000,000-gallon duplex compound condensing pumping-engine. Until December 8, Address A. H. McAlpine, Superintendent Water-Works Trustees, Columbus, O.

GRADING, EXCAVATING, ETC.—Proposals are wanted at Peekskil, N. Y., for grading, excavating rock and earth, filling in roads and ravines, and building retaining-walls, culverts, etc. Until December 16. Address communications to the Commissioners, State Arsenal, Thirty-fifth Street and Seventh Avenue, New York City.

ENLARGING DRILL-HALL.—Proposals wanted at Brooklyn for enlarging the drill-hall of the State Armory, and other work in connection with the same. Until December 12. Address Commissioners, State Arsenal, Thirty-fifth Etreet and Seventh Avenue, New York City.

WATER-PIPE — Proposals for furnishing and laying cast-iron 6-inch water-pipe are wanted until December 8, at St. Louis. Mo. Address C. W. Foster, Quartermaster, U. S. A., Depot Quartermaster.

WATER-TUNNEL.—Proposals warted at Milwaukee for the construction of a water-tunnel, twelve feet in diameter. Until December 8. Address Board of Public Works.

BUILDING.—Proposals will be received until December by J. C. Saunders, Arkadelphia, Ark., for building colleges.



TOO LATE FOR CLASSIFICATION.

FORT BENTON, MONT.—Water-works are to be constructed. For particulars address the Water Commissioners.

JACKSONVILLE, ILL.—The City Council has decided to advertise for proposals to furnish the city with not less than 1,000,000 gallons of water per 24 hours.

HARRISBURG, PA.-Contractor Oglesby, of this city, is erecting water-works at the Soldiers' and Church Orphans' Home at Loysville, Perry County.

GUYANDOTTE, W. VA.—This place is to be supplied with water by the Huatington Water-Works Co.

TEMPLE, TEXAS. - Major Burkett, of Houston, Texas, has made a proposition to erect water-works here.

MACON, GA.—The Jeter-Boardman Water and Gas Association has been organized to build water, electric light and gas-works at different places. W. W. Jeter is president.

SHERMAN, TEX.—Urb n Broughton, of Chicago, Ill., representing the Shone Pneumatic Co., is figuring on the cost of a sewerage system for this place. About \$60,000 has been appropriated. For details address the Mayor.

OXFORD, N. C.—A water-works plant is to be established here. Address the Mayor.

HILLSBORO, ILL.-A water-works committee has been appointed and an engineer will be employed to prepare plans and superintend the construction of the proposed works.

SALEM, DAK. - A system of water-works is to be established here.

PIPESTONE, MINN .- The National Iron and Brass Works, of Dubuque, Iowa, have been awarded the contract for the construction of a system of water-works here.

DOVER, N. H., November 30, decided in favor of building new water-works. The con-struction of the water-works will begin in the

BONHAM, TEX.-The City Council has determined upon a complete system of water-works and the officials have been inspecting the works of other cities. Action will probably be taken shortly.

PHŒNIX, ARIZ.—The City Council has granted a franchise for water-works to J. J. Gardiner.

HYDE PARK, ILL. - The Kensington Electric Light Co. has applied for a charter to establish and operate a plant here.

IONIA, MICH.—This place is advertising for bids for lighting the streets by electricity.

SAN ANGELO, TEX.—T. O. Richards, of Chicago, is to establish an electric-light plant here at once.

FAYETTEVILLE, N. C .- F. C. De Richards has closed a contract to erect water-works here.

WACO, TEX.—The King Iron Bridge and Manufacturing Co., of Cleveland, O., has been awarded the contract for the construction of a bridge over the Brazos River. Cost, \$49,500.

BENTON, KAN -W. G. Harvey, of Atchison, will build three bridges here.

CINCINNATI, O .- The County Commissionbu ld a bridge over the Miami River. Fred Paine is in charge.

PORT TOWNSEND, N. Y.—Synopsis of bids for masonry, iron, and carpenter work of second floor Custom-House, opened November 30 by the Supervising Architect of the Treasury Department:

Bidders.	Stone facing.	Brick facing.
James B. Halliday and William	\$21,50C	\$14.300
J. I., Middlebrook	20,350	20,350
John O' Johnor	27.300	26,500
Bart ett & Wilkes	30.620	24,175

* Brick and stone as per drawings.

LEAVENWORTH, KAN.—Synopsis of bids for approaches to Court-House, earth, stone and brick-work, drain-piping, Belgian block paving, macadam roadway and wood fence, opened November 30 by the Supervising Architect of the Treasury Department:

Owen Patterson, \$5,155. McCarthy & Baldwin, \$5,310. A. French, \$2,980 William T. Yoakum, \$2,690.

NEW YORK CITY.-Synopsis of bids for building a new crib-bulkhead at the foot of West 158th Street, and for dredging thereat, opened December I by the Commissioner of the Department of Docks. The engineer's estimate gives about 9,000 cubic yards dredging and about 98,600 cubic feet, more or less, of crib work. The bidders were: Joseph Walsh, New York, \$19,000; John Monks, \$21,675; J. W. Fl A. Gillies, \$14,360. W. Flaherty, \$18,500; Duncan

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; afart house, upar teni-house; ten, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

118th, n s, 65 w Lexington av, 1 brick ten with stores; cost. \$13,500; o, Wm C Boyd; a, Cleverdon & Putzel.

100th, s e cor West End av, br and st dwell; cost, \$11,000; o, Townsend & Odell; a, R S Townsend.

West End av, e s, 17.5 s 100th, 2 br and st dwells; cost, each, \$9,000; o, a, and b, same as above.

100th, s s, 57.6 e West End av, 2 br and st dwells: cost, each, \$9,000; o, a, and b, same

132d, s s, 75 e 7th av, 3 brick dwells; cost, each, \$10,000; o, Mary E Carlin; o, A Spence.

S s 121st, 100 e 1st av, 3 br flats; cost, \$45,-000 all; o, Wm Radebald; a, Ed Wenz. S s 91st, 267 w 8th av, 6 br dwells; cost, \$120,000 all; o, D M Lyon; a, W H Boylan.

S 5 68th. 150 e 9th av, 8 br dwells; cost, \$160,000 all; o, Susanah Osborn; a, C M Romesn.

887-89 2d av, br storage; cost, \$35,000; o, Thos McLean and Wm F Morgan; a, De Lemos & Cordes.

94-96 Varick, flat and stores; cost, \$30,000; o, Joel G Hyams; a, Herter Bros.

S s gist, 112 e Madison av, 2 br dwells; cost, \$20,000 all; o, E Stanley Cornwall; a. G A Schillinger,

S s 122d, 100 e 8th av. 2 br flats; cost, \$36,oou all; o, Samuel Edgar: a, same as above.

W s 10th av, 513 n Little 12th st, br store; cost, \$15,000; o. James Fay; a, same as above 171-73 Avenue C, 2 br flats; cost. \$34,000 all: 0, Chas Downey: a, Alex J Finkle.

E s Locust, 78 n 138th, br and glass factory; cost, \$15,060; o, Central Gas Light Co; a, not ALTERATIONS.

408 E 104th, br factory; cost, \$8,000; o, Wm A Jach; a, Geo Mathais.

BROOKLYN.

Franklin, s e cor Huron, 2 fr store and ten; ost, \$6,800; o and b, Charles Schroth; a, Th Engelhardt

76 Manhattan av. e s, 350 n Van Cott av, I fr ten; cost. \$5,000; o and b, Fred Schmelze, a, Th Engelhardt.

280-282 Washington av, 475 s Willoughby av, 2 b s dwells; cost, \$30,000; o, Mr. Charles Ehrhardi; a, M. J. Morrill.

De Kalb av, s s, 80 e Reid, 6 br and s stores and tens; cost, each, \$6.000; o, Margaretta Mulvihill; a, H Vollweiler.

Kingston av, s e cor Atlantic av, 1 b s store and ten; cost, \$15,000; o and a, W M Coots.

E s Kingston av, 24 s Atlantic av, 4 br dwells; cost, \$24,000 all; o and a, W M Coots. Se cor Reid and DeKalb avs, 2 br stores and dwells; cost, \$16,000 all; o, Margaretta Mulvihill; a, H Vollweiler.

Es Reid av. 20 s DeKalb av. 6 br stores and dwells; cost, \$57,000; o and a, as above

E s Bushwick av, 50 n Cooper av, 2 fr dwells; cost, \$8,000 all; o, John Hentchel; a,

David Acker & Son.

S s 10th, 325 e Third av, br dwell; cost, \$10,000; 0, Henry Hoffman; a, Maurice Free-

E s Driggs, 125 n N 10th, br ten; cost, \$8,000; o, Joseph T Gately, a, A Herbert.

N s 19th, 125 e 9th av, fr stable; cost, \$13,000; o, Atlantic Av RR Co; a, not given. 52-66 Meserole, br machine bldg; cost, \$11,000; o, Joseph Fallert Brew Co; a, Fred BUILDING INTELLIGENCE. BROOLLYN-(Continued).

N s Lexington av, 300 e Stuyvesant av, 5 br dwells; cost, \$22,500 all; o, George Walker; a, John E Dwyer.

S s 10th, 150 e Fifth av. 3 br dwells; cost, \$13,500 all; o and a, W T Gonigan.

WORCESTER, MASS.—Woodland st, fr house: cost, \$5,000; o, C O Richardson; b, Geo Kingston.

Ashland, fr house; cost. \$8,000; o, Union Congl Church; b, C Vaughan.

ST. PAUL. MINN.-Olive nr Grove, 5-story fr dwells; cost, \$7.500; Walter Ife, agent.

Oakland nr Lawton, 2 5-story fr dwells: cost, \$7.700; o, F. P Sanborn.

45 minor permits, \$23,800.

WASHINGTON, D. C .- 56-68 K, NE, -story brick bldgs; cost, \$10,000; o, J Mc-Carthy; a, same.

1709 Mass av, 1 3-story brick bldg; cost, 25,000; o, Katherine Smith; a, J G Hill; b. Langley & Gettenger.

Kingman pl. 2 3 story brick bldgs; cost, \$7,500; o, M Ragan; a, W B Gray; b, H Renninger.

1425-1447 C, SW, 11 2-story brick bldgs; cost, \$23,600; o, S Norment; a, J H Grant. 1406-1408 16th st, 2 3-story brick bldgs: cost, \$44,000; o, Geo E Simon; a, H L Page; b, J K Cramer.

1329 10 st, NW, I 3-story brick bldg; cost, \$7,000; o, T Lanston; a, T J Collins; b, H C Walter.

641-643 Penn av, 2 3-story brick bldgs; cost, \$7.000; o, Swornstead & Bradley

1315 12th st, 1 3-story brick bldg; cos \$8,000; o, Chas King; a, R Stead; b, O W Gotwalls.

53 permits less than \$7,000 in value for

ST. LOUIS, MO .- 17th and Franklin av, a brick dwell; cost, \$14,000; o, S Simmons; a, E Mortimer, b, F E Brussack.

GEORGETOWN, IND -Iron bridge works are to be started here by E. S. Dent & Co.

CHATTANOOGA, TENN .-- A Jewish temple is to be erected here at a cost of \$20,000.

WASHINGTON, D. C .- Secretary Whitney has approved the plans for the new Naval Observatory prepared by Architect Richard Hunt, and bids for constructing the building will be invited in a few days.

ST. PAUL, MINN.—Main, nr McLean, 2-fr dwell; cost, \$15,000; o, Miss A W Yan-

Condon. nr Langdon. 2-story fr dwell; cost, \$7,000; o, Walter Ife. 20 minor permits, \$25,000.

MILWAUKEE.-N w cor Milwaukee st and Juneau av, br dwell: cost, \$10,000; o, A Meinecke; a, C F Ringer.

Astor, nr Martin, br dwell; cost, \$10,000; o, T J Perles; a, E T Mix & Co. 7 buildings less than \$7,000.

NEW ORLEANS, LA. -St Charles and Constantinople sts. 2-story granite and frame residence; cost, \$17,000; o. Isidore Hernsheim; a. Thos Sully & Co; b, Kelly Pros.

Magazine and Girod sts, brewery bldg; cost, \$50,000; o, N O Brewing Co; a, Wm Fitzner; b, A Thiesen.

I.OS ANGELES, CAL.—The Atchison and Topeka Railroad will build a depot to cost The Southern Pacific will erect an \$40,000. **\$**80,000 depot.

CHICAGO .- 16-28 Pratt pl. brick flats and dwell; cost, \$14,000; o and a, C B Wilson; b, Geo Lehman & Sons.

ASHLAND, KAN. - Our writes: "Bonds in the sum of \$30,000 have been voted for a new court-house, and the plans and specifications are now on file at the County Clerk's office. It will be built this winter and spring.

TUSKALOOSA, ALA.—A stock company is being formed to build a large opera house. J G Brady can give particulars.

INDIANAPOLIS, IND.—The sum of \$500,-000 has been raised for the purpose of piping natural-gas to the city.

BUILDING INTELLIGENCE.

BALTIMORE, MD.—Nothing over \$7,000 to report.

BOSTON, MASS.-46 Waltham, rear, stone mechanical bldg; cost, \$14,500; o, R Codman, Trustee; b, A Hathaway

Mellville av, cor Allston, fr dwell; cost, \$12,000; o, J Breckenridge; a, L Under-wood; b, R F Parker

305-18 Washington st, 5 fr dwells; cost each, \$7.000; o, Edward A White; a and b, A S Drisco

Argyle cor Ashmont, fr dwells and stores; cost, \$11,000; o, Chas F Kittredge; b, John McDonald

341-47 Adams, fr dwell and stores; cost, \$8,500; o, John J Merrill; b, Noyes

Wareham and Albany, br piano m'i'y; cost, \$45,000; o, John Church; a, Samuel D Kelley; b, Webster & Dixon

1784-86 Washington, br store and dwell; cost, \$8,000 o, C A Richards; a, John Quirk; b, Webster & Dixon

1788-00 Washington, br store and dwell; cost. \$10,000; o, a and b, same as above

1780-82 Washington, br store and dwell; cost, \$8,000; o, a and b, same as above

107-113 Falmouth, 2 br apart; cost each, \$13,000; o and b, Peter Graffam

153 Huntington av, br apart; cost, \$15,-000; o, E B Horn; a, Samuel D Kelley; b, Keening & Strout

95-101 Falmouth, 5 br dwells; cost each, 13,000; o and b, Peter Graffam, a, F. Griffin

268-70 W Newton, 2 br apart; cost each; 8,500; o, E B Horn; a, S D Kelley; b, Keening & Strout

23 St Charles, br apart; cost, \$25,000; 0, L Potter; a, Fred Pope; b, Joseph Nicholson

151 Huntington av, br apart; cost. \$18,-00; o, E B Horn; a, S D Kelley; b, Keening & Strout

Stamford, br store and dwell; cost, \$12,-000; o. Thompson, Allen & Gibson

156-60 Merrimac, 2 br stores and dwells: cost each, \$11,000; o, A Ratshisky; a, John A Hasty; b, Stephen Brennan

West Camden, br stable; cost, \$7,000, o, Frank Smith; b, Gooch & Pray

509 Beacon, br dwell; cost. \$11,500; o, Samuel S. Allen; a, Carl Fehmer; b, James Smith Lincoln, 8 br mercantile stores: cost.

\$180,000; o, John S Farlow; a, Cummings & Sears; b, Woodbury & Leighton

105-17 South, br mercantile bldg; cost, \$48.000; o, Charles Toney; a, Chamberlain Whidden; b, Whidden, Hill & Co

DETROIT.—225 Adams, brick dwell; cost, \$7,000; o, E Blackwell; a, H Kock; b, C Schwartz & Son.

40 Columbia, br dwell; cost, \$9,000; o. J Hurley; a, Hess & Raseman; b, P Dee. Cass, br dwell; cost, \$9.000; o, M E Compton; a, W G Malcolmson; b, G Gra-

Orchard, br shop; cost, \$7,000; o, C H Haberkorn; a, W G Malcolmson; b, W H Hollands.

Trumbull, br dwell; cost, \$7,000; o, E Sullivan; a and b, same as above. 54 Warren, br dwell; cost, \$7,000; o, L

Jones; a, Mason & Rice; b, H Carew. 690 Jefferson. br dwell; cost, \$12,500; o, J Dwyer; a, Scott & Co; b, H Carew.

Hancock, br dwell; cost, \$7,000; o, L Witzleben; a, Spier & Rohns; b, C Schwarz.

Lewis, br dwell; cost, \$17,000; o, C L Clark; a, Mason & Rice; b, G Vivier.

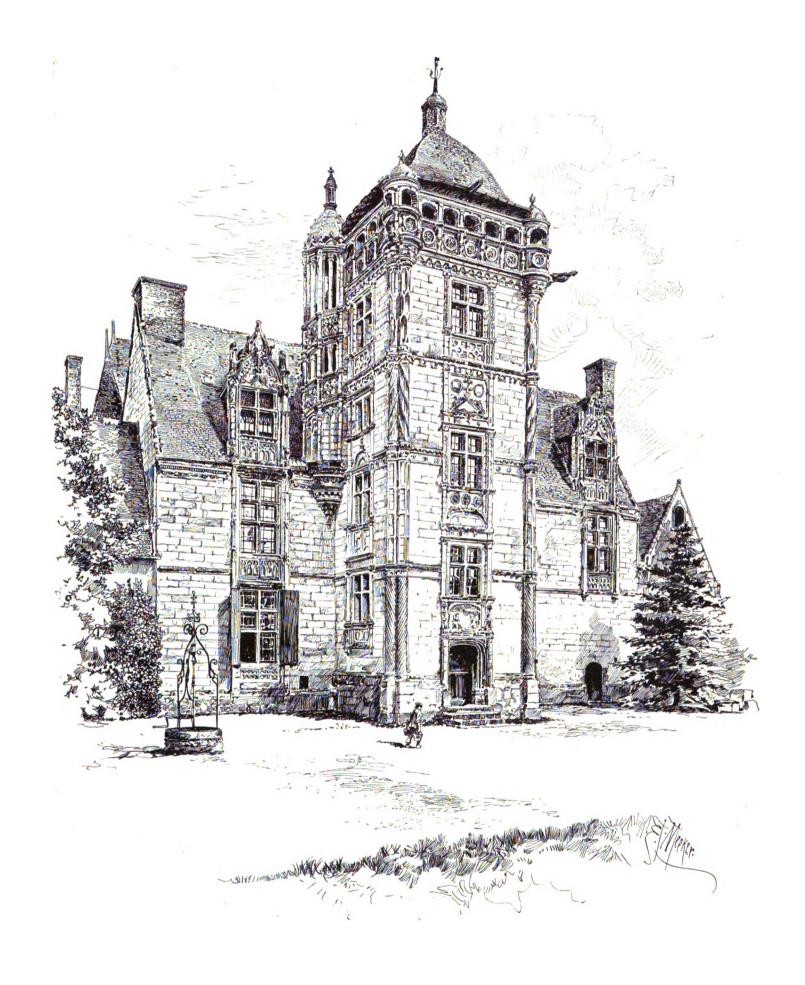
75 Watson, br dwell; cost, \$8,000; o, J N Jamison; a, M S Smith; b, W H Traves

MONROEVILLE, IND .- Messrs. Wing & Mahurin, of Fort Wayne, have completed plans for a Catholic Church to cost nearly \$10,000.

FINDLAY, O .- Dr W L Davis can give particulars of an opera house which is to be erected here at a cost of \$100,000.

BERKELEY, CAL.—A hotel to cost \$150,-000 is to be erected here by Dr George M Baronidas and others.





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

CHATEAU D'ECOUEEN, MAYENNE, FRANCE.

THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

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A CIVIL ENGINEER PRESIDENT OF FRANCE.

ALL of our readers have noticed, and doubtless some of them with more or less of professional pride, that the recently elected President of the French Republic, M. Marie Francois Sadi-Carnot, is, like M. de Freycinet, a civil engineer. As the *World* says: "One of the foremost civil engineers of France, his training as an engineer and a political economist fits him in a quite particular manner for the high office to which he has been elected.'

It is a fact worth noting that of the so-called "learned professions," law, medicine, and divinity, to which, in these days of multiplied technical schools, that of engineering must certainly be added, the latter is chiefly, if not solely, the one which qualifies its practitioner for high executive position.

An engineer—and in its widest sense this includes the architect as well—is one trained to subjugate the forces of nature to the service of man, and this usually by planning and directing the organized effort of many men. In large enterprises, like a great railway, the conflict with nature assumes vast proportions, and thousands of men and millions of money are employed, while an interoceanic canal becomes an affair of national importance. As an illustration, M. Sadi-Carnot's professional staff, while Minister of Public Works, included 72 chief engineers, 270 ordinary engineers, and 1,500 assistant engineers. It is a little singular that, in this country especially, which is perhaps indebted more to its engineers than any other set of men for its marvelous development, the engineer has received such scanty reward and almost no political preferment.

While the satirical paraphrase of a sentence in an address of Lincoln's, that this is "a government of the lawyers, by the lawyers, and for the lawyers," is hardly true, it is nevertheless a fact, that, perhaps from the facile combination of law and politics, the legal profession occupies a disproportionately large number of the official positions in this country, and however well fitted a lawyer may be for a legislative or judicial position, it is time we thought seriously of utilizing for executive positions some of the high executive ability fostered and manifested in the profession of the engineer.

It seems proper, then, that the members of the profession, when opportunity may offer, should encourage a recognition of this policy, not as engineers merely, but as wise and patriotic citizens trained to accomplish the best results by the best methods through the best men.

UNDERGROUND FROM FOURTH AVE-NUE TO THE CITY HALL.

THE New York Times is authority for the statement that plans have been prepared, the consent of the property owners secured, and the necessary capital subscribed for a four-track underground road on the line of Elm Street from Fourth Avenue to the City Hall, the proposed widening and extension of Elm Street to be taken advantage of for the construction of the proposed subway. It further intimates that W. K. Vanderbilt, Cornelius Vanderbilt, Chauncey M. Depew, Orlando B. Potter, John Jacob Astor, William W. Astor, the Rhinelanders, the Lorillards, and many other representative people have embarked in the enterprise. If so they but follow the policy of the late Cornelius Vanderbilt and revive a project on which he had nearly embarked. It may not be generally known that in 1873 he had proceeded so far with a scheme to extend the railway tracks on Fourth Avenue under-ground from the Grand Central Depot to the City Hall that the contracts were placed and all ready for signature, when at the last moment, perhaps suspecting the troublous times that soon followed, he concluded to go no further.

Had his project been then carried out it might have postponed or prevented the construction of the elevated roads, and New York might by this time have had a complete system of underground transportation.

We are glad to welcome the new enterprise, and believe Mr. Vanderbilt's successors will vindicate the wisdom of his original plan, more daring and difficult then than now. It will in all probability give an effectual quietus to the Arcade and Underground schemes for Broadway, though they may perhaps find more feasible routes west of that thoroughfare. It will not, however, afford much relief to the travel on the west side, where, as we have long advised, a substantial viaduct through blocks should be constructed on property bought and paid for. While the Elm Street tunnel will be a great boon to dwellers in Harlem and the new district, the west side viaduct is needed for the Hudson River side of the city and to build up that beautifui residential portion at and beyond Manhattanville.

HOSPITAL ORGANIZATION AND MAN-AGEMENT.

THE report of the Dublin Hospitals Commission, recently published, with its appendices, forms a folio volume of over 350 pages, which is interesting reading, not only to those immediately concerned, but also as an historical document of permanent value.

Dublin has more hospitals in proportion to its population than any city in the United Kingdom, and the result is that most of them are insufficiently supported, and that the expenses of management are disproportionately large.

Dr. Corley's expression that "we are over-hospitalled, but not over-bedded," seems to hit the mark.

The questions dealt with by the Commission relate largely to local details, as bearing on the general subject of the Parliamentary grant of funds for the Dublin hospitals and the methods of its distribution. It advises consolidation into five or six hospitals, and that the conditions upon which the Parliamentary grant is distributed shall be such as to promote this consolida-These conditions afford some useful hints about hospital organization in large cities, and we therefore give them in full.

"First—The hospital shall contain not less than eighty beds, and after five years' participation in the grant, not less than one hundred, in daily occupation throughout the year.

"Second-The hospital shall be open for clinical instruction, and shall have not less than fifty pay-

ing students on its books each year.

Third—The hospital shall be open to persons of all creeds, without any distinction, and clergymen of, all denominations shall be admitted to see patients requiring their ministrations at any hour of the day or night.

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"Fourth-The staff of the hospital shall be appointed without distinction of creed or the place of education, or reference to the candidate's connection with any particular university or medical corporation or hospital, and without payment of any sum of money; and the principle of promotion from the junior to the senior appointments shall be recognized as far as may be deemed compatible with the interests of the institution. No member of the staff shall hold a similar appointment in any other hospital.

"Fifth—The junior appointments, such as resident surgeons and physicians, shall be filled up by examination, for which any duly qualified candidate may present himself.

"Sixth—The hospital shall employ as nurses only such persons as have gone through a duly recognized probationary training."

We commend these rules to the consideration of those who may be on the boards of management of hospitals.

There will be a main under each sidewalk, as no serviceline will be allowed to cross the roadway. Only main lines can be carried across the roadways (at a depth of one metre), and man or hand holes at each end of a crossing will give access to the wires under the street.

All switches, cut-offs, etc., shall be outside of the street

All plans to be deposited in triplicate with the city and kept up to date.

Repairs of sidewalk and road-beds to made by the city and paid for by the company at the following rates: paved road-bed, \$0.09 per square foot; macadam bed, \$0.055 per square foot; asphalt bed, \$0.335 per square foot; wood pavement, \$0.428 per square foot; bitumen sidewalk, \$0.145 per square foot; granite sidewalk, \$0.09 per square foot; price of curbing, straight or circular, \$0.200 per piece. The company to maintain temporary repairs of road-bed over their trenches (for not over fifteen days after refilling) till accepted by the city. All repairs of sewer-work, water-pipe, etc., to be paid by the company according to the bill of work kept by the city in-

buildings, etc., to be determined by experts at their market value at time of sale.

value at time of sale.

Everything to be put back into its original shape on completion of the eighteen years, if the charter is not renewed or bought up.

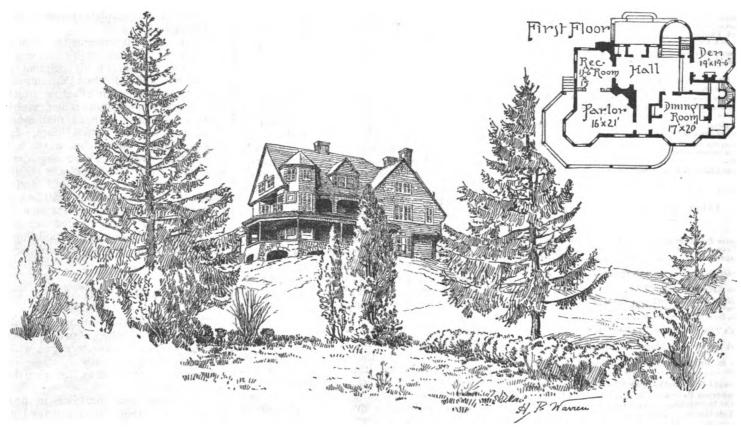
Company to give bond to the amount of at least \$5,000 at the rate of \$2,000 per kilometre of conduit.

Not over ten per cent. of foreign labor to be employed. The company to hold the city free from all claim for damages. Damages done to conduit by city contractors to be repaired by contractors, but the city not held liable for it.

OUR SPECIAL ILLUSTRATION.

CLUB HOUSE FOR THE DOWN TOWN ASSOCIATION OF NEW YORK.—C. C. HAIGHT, ARCHITECT.

This building is situated at 60 and 62 Pine Street, extending through to Cedar Street. It is used as a clubhouse for the Down Town Association of New York. Material used on the Pine Street front, the lower part is of Belleville, N. J., sandstone, upper part of buff brick, with buff terra-cotta trimmings. Cedar Street front is of similar character, with red brick and terra-cotta. The entrance-hall, office, and lavatories have marble mosaic floors. hall, office, and lavatories have marble mosaic floors. Principal rooms finished in dark oak, with large open fire-places and oak chimney-pieces. The main staircase is of



RESIDENCE OF CLARENCE WHITMAN. NEW BRIGHTON, STATEN ISLAND.-LAMB & RICH, ARCHITECTS.

THE FORM OF LICENSE FOR ELECTRIC-LIGHT COMPANIES IN PARIS.

THE city of Paris, France, received a revenue from the gas company monopoly in 1886 of some \$3.500,000, of which \$40,000 was for right of way (some 900 miles), some \$2,500,000 being the city's share of the profits, and nearly \$1,000,000 in form of a tax of eleven cents per 1,000 cubic feet of gas consumed, which takes the place of the regular tax on all coal entering the city.

In making out a form of charter or license for electric light and power companies, the city officials had to take into account the diminution in revenue the city is likely to get from the gas companies. From Le Genie Civil we learn the following are the principal features of the pro-

Wires to be laid in the sewers where there is space enough and when they will not interfere with other public services, but the city reserves the right to order them out if the space is needed for other purposes, or there are any

When not laid in sewers the wires shall be laid under the sidewalks in suitable metal or masonry conduits. spector. The license to last for eighteen years, but city reserves right to buy up the right and plant after seven years. The license only covers the right of way actually taken up by the wires, the city reserving the right to license other companies for the same district and same streets. The maximum charge made by the company for use of its light or power is fixed at \$0.012 per carcel hour, or \$0.12 per horse-power hour.

The company is bound to furnish electricity to any one on the lines of its wires who may desire it on the terms of on the lines of its wires who may desire it on the terms of ts policies. The company to pay the city an annual tax of \$20 per kilometre of conduit and five per cent. of the amount of its policies. If the electric stations are outside the city limits this amount will be six per cent., the addition representing the city tax on coal. The company to pay all costs for verifying the power of light, income, etc. The license to be annulled if work is sublet to outside section if more is not begun within six morths of data of The license to be annulled it work is subjet to outside parties; if work is not begun within six months of date of license; if the supply of electricity is partially or totally cut off; if taxes are not paid up in time.

The basis of buying out by the city after seven years will be the average net revenues for the five preceding years, which will be paid the company in annuities for the rect of the term of license in the company in annuities for the

rest of the term of license; or the corresponding capital at six per cent. paid at once. Price for plant, tools, main s,

iron, with marble treads. There is an elevator from ground-

iron, with marble treads. There is an elevator from ground-floor to upper dining room floor.

The first floor contains the entrance-hall, in which is the office, and adjoining on the east side are the reception-room, telephone-closet, and lavatory. On the north side a spacious opening leads to restaurant, 40x48, passing on the way by staircase at the right, and coat-room and elevator at the left hand.

On the second floor above the entrance-hall and reception-room is the reading-room 32x43, connected with the smoking-room, which is over restaurant, by the staircase-

Two dining-rooms occupy the larger part of the third floor, of similar dimensions to rooms on floor below, and on the floor above are found a number of private dining-rooms. The kitchen is on the top floor. The cost was about \$150,000.

The architect was Mr. Charles C. Haight, of New

OUR VIGNETTE ILLUSTRATION.

RESIDENCE OF CLARENCE WHITMAN, NEW BRIGHTON, STATEN ISLAND.

THE subject of our vignette illustration is the residence of Mr. Clarence Whitman, New Brighton, Staten Island. The building is of wood, shingled. The architects were Lamb & Rich, of New York.



HENRY IRVING'S "SAFETY THEATRE."

WE reproduce a plan and section of this interesting building from the London Architect, to which paper the blocks were loaned by the Daily Telegraph. The former says:

"It will be observed that the designers have adopted the theory of Wagner in avoiding many ranges of boxes and galleries. The building may be said to have but one story, and the lowest-priced seats will be found in the rear of the pit instead of at a lofty height, but it is said that the most distant seat will command an extensive view of the stage. How far a theatre so disposed would pay the lessee is a question not easily solved. There can be no doubt if safety depended upon facilities of exit it is to be found in the new theatre, and people would probably pay a higher price for having some hours' enjoyment without any apprehension of danger."

THE NEW YORK ARCHITECTURAL LEAGUE.

On Monday evening last the league dinner and subsequent meeting was an unusually successful and enjoyable affair, about sixty members being present. Mr. J. P. Riley gave an entertaining word picture under the title, "A Day in Florence." Mr. E. K. Rossiter read an interesting paper on "An Old Colonial House in Connecticut"-the Demming Homestead at Litchfield-the architect of which was Mr. Spratt, who had been a Hessian soldier in the Revolution. His description of the methods of construction in vogue at that day excited considerable interest. The record of what an architect's fee was at that time was the charge for a day's service of 7s. 6d. about \$1.87 %. The frame of the house was hewn timber. with oak planking three inches thick. The hardware came from England, and the author made a point of the fact that the workmen were more than usually intelligent in their craft in carrying out the architect's designs by reason of their seven years' apprenticeship in the old country.

A subscription was taken up from those present at the dinner for the medal, for which \$170 was secured at the time. The jury to select a design for a medal from the drawings that have been invited is to consist of R. M. Hunt, C. F. McKim, Russell Sturgis, as non-members of the league; W. C. Hazlett, J. Du Fais, and C. I. Berg, members.

The Hanging Committee selected for the approaching exhibition of drawings are: J. Du Fais, Bruce Price, F. A. Wright, E. P. Treadwell, and J. B. Robinson. The names of the officers to be voted on for the ensuing year were also posted. From the announcements made by the Executive Committee, there is every indication that the approaching exhibition will be the most successful one yet held.

EXAMINATION IN ARCHITECTURE—ROYAL INSTITUTE OF BRITISH ARCHITECTS.

THE following extracts from the examination papers of the Royal Institute of British Architects may be of interest to students of architecture in the United States as showing the line of study followed in England.

THE EXAMINATION.

All gentlemen engaged in the study or practice of architecture, before presenting themselves for election as associates, are required to have passed an examination according to a standard fixed by the Council of the Royal Institute of British Architects; and in places where a scheme of examination, approved by the said council, has been formulated, the examination is conducted by means of sealed papers under the charge of members of the Institute, who act as moderators, superintend the oral examinations, and report thereon. In all cases the candidates' answers, written and graphic, and the reports of the moderators, are transmitted to the council of the Institute for decision. The examination is conducted in accordance with the following principal regulations and programme:

PROGRAMME OF WORK TO BE DONE IN PRESENCE OF MODERATORS.

History of Architecture (to be illustrated by sketches).

The leading characteristics and history of the principal styles of architecture.

The special characteristics and history of any one of the following periods which the candidate may select, namely:

- (a) Greek or Roman architecture;
- (b) Architecture of Italy or France from the Tenth century to the end of the Fourteenth century;
- (c) Architecture of Italy or France from the beginning of the Fifteenth century to the present time;
- (d) Architecture of England for some one century between the years 1100 and 1700 A. D.

Moldings, features, and ornaments (to be illustrated by sketches).

As characteristic of architectural styles generally.

As characteristic of the special style which may have been se ceted by the candidate.

Sanitary science, strength of materials, shoring, etc.— Drainage, sanitary arrangements and requirements.

The application of formulas for calculating the strength

Shoring and underpinning, and dealing with ruinous and dangerous structures.

Plans, section and elevation of a building.—The detailed arrangement of a building for a given purpose, as for example, a parsonage for a town parish, a residence for a surgeon or other practitioner, a set of offices, to be filled in upon a skeleton plan (a scale of 1/8 of an inch to a foot).

A plan of one upper floor and of the roof, with details

of the principal constructional arrangements.

The section and elevation (to a scale of 1/8 of an inch to a foot), with constructional and artistic details to a larger scale.

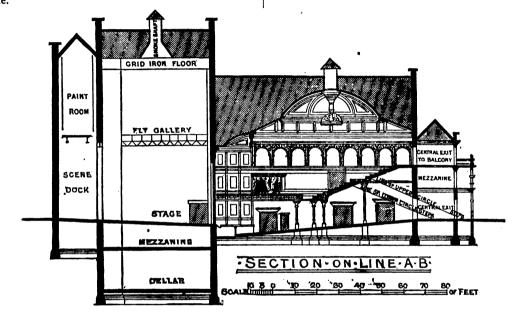
100; plans. section, and elevation, 200; materials, construction, etc., 100; specifications and methods of estimating, 75; professional practice, 25.

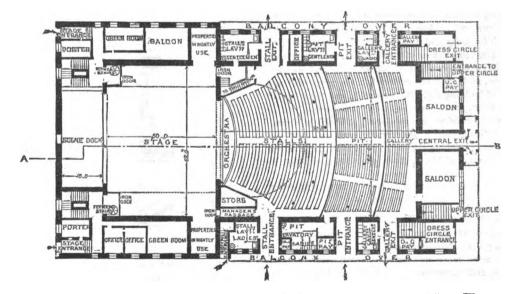
A candidate in order to pass must obtain at least half the number of marks (namely 350), though this proportion need not necessarly extend to each of the several divisions.

ADVICE TO CANDIDATES DESIROUS OF ENTERING FOR THE EXAMINATION.

As a general foundation for the knowledge necessary to pass the examination in all its branches, a careful study of Gwilt's *Incyclopædia*, which should be in the possession of every architectural student, will be found of great service; the student will there find almost all the subjects required dealt with concisely, but at sufficient length to form an admirable introduction to the specific study of each.

For the history of architecture the earlier chapters of Gwilt's, Fergusson's History, Gailhabaud's Monuments, Batissier's L'Art Monumental, Ramée's Histoire Générale,





GROUND PLAN OF HENRY IRVING'S "SAFETY THEATRE." == :

Materials, construction, etc.—The nature and properties of building materials, including their decay, preservation, quality, and strength, and their application to building

The principles of construction as applied in practice to foundations, walls, arches, vaults, roofs, floors, and partitions.

Specifications and Methods of Estimating Cost.—A specification of the work necessary in one or more trades for the building designed by the candidate.

Manner of specifying for other trades and methods of estimating the cost of any building.

Professional Practice.—The general conditions usually appended to a specification and contract.

The number of marks allowed by the examiners will be 700, thus subdivided:

History of architecture, illustrated by sketches, 100; moldings, features, and ornaments, illustrated by sketches, 100; sanitary science, strength of materials, shoring, etc.,

etc., etc., should be supplemented by the biographical works of Milizia and Quatremère de Quincy, while, for those who have the opportunity, the lives of the architects treated of by Vasari will afford much instruction. The special text-books relating to each style will also afford detailed information to which that contained in the preceding works can only be considered as introductory; the more important of these text-books are mentioned in the succeeding paragraphs, the observations in which apply equally to this head of history.

While each candidate will be required to show a thorough acquaintance, graphic and historical, with the style and period selected by him, he will also be expected to show a knowledge of the history of other styles.

For moldings, features, and ornaments, in the special style selected by the candidate, acquaintance should be obtained by drawing, measuring, and sletching an actual building, aided by careful study of the most accessible of

the standard works, a thorough acquaintance with which should be acquired.

For Greek Architecture.—The study of Stuart and Revett's Antiquities of Athens, Wilkins's Magna Græcia, the Society of Dilettanti's Antiquities of Ionia and of Attica, Mr. Penrose's Athenian Architecture, and Cockerell's Ægina, is indispensable.

For Roman Architecture.—A knowledge can be acquired from Taylor & Cresy's Antiquities of Rome, Adam's Spalatro, Wood & Dawkins's Palmyra and Balbec; from Palladio, Canina, etc. The orders are well shown in Mauch, Normand, Nicholson, Chambers, and Gwilt; and classic ornament is shown in Vulliamy, Tatham, etc.

For Mediæval Architecture.—Reference should be made to Sharpe's Parallels, Pugin's Normandy, Paley's Moldings, Brandon's Analysis, Colling's Details and (rnaments; to Rickman, Bloxam, and to Viollet-Le-Duc's Dictionnaire.

For Renaissance Architecture.—Of the history and of the architects of this period every candidate will be expected to have a knowledge, which can be acquired from Letarouilly's Rome, and from Pallaido; from Granjean and Famin's Toscane, Percier & Fontaine's Rome, and Cicognara's Venezia; and the careful perusal of Sir William Chambers's Treatise on the Decorative part of Civil Architecture should not on any account be omitted.

The candidate must distinctly understand that he will be required to show a reasonable acquaintance with styles and periods other than that selected by him.

For Plan, Elevation, Section, etc., the experience acquired in office practice may, with advantage, be supplemented by attendance at the Architectural School of the Royal Academy, the Classes of Design and Construction of the Architectural Association, and the classes of local societies.

For Materials and Construction the knowledge gained in office work and in the inspection of buildings in progress should prove useful. The three volumes of Notes on Building Construction will be found of great value-in fact, indispensable; and the Pocket-Books of Hurst & Young should be carefully studied: Tredgold & Newland on Carpentry, Rankine's Manuals of Applied Mechanics and Civil Engineering, Stoney on Strains, Mr. Tarn's Science of Building, Stock's Shoring and Underpinning, and other technical works, may be studied with advantage. Applied mathematics and geometry may form part of the examination, and readiness of calculation and acquaintance with formulas and their application will be appreciated. The construction of floors and roofs; the methods of calculating the strength of timber, cast and wrought iron beams, and of other materials; the properties and qualities of building materials generally, and the modes of applying them, must be studied under this head.

For Sanitary Science a careful study of Parkes's Manual of Hygiene is desirable; and for the practical details of drainage and plumbing the works of Mr. B. Latham, and Bailey-Denton, and Mr. Hellyer, should be consulted.

TEST OF A WROUGHT-IRON DOUBLE-TRACK FLOOR-BEAM.*

BY ALFRED P. BOLLER, MEM. AM. SOC. C. E.

"TESTING to rupture actual bridge members is always a matter of great scientific interest, and while the record is quite extensive in eye-bars, posts, or small parts, the great cost, time, and inconvenience of handling heavy girders has prevented experiment in that direction. In fact, the writer is unaware of any experiment upon compound riveted beams on a large scale, as actually used, until the experiment recorded below was made under his supervision.

The beam was an exact duplicate of those in use on a bridge, about which more or less controversy had arisen as to their practical safety, and the test was made under, as near as possible, actual conditions of attachment and loading. The annexed drawing shows the form and proportion of the beam and connection with the posts, together with the position of the track-stringers. The actual static loads to which the beam could be subjected by the heaviest engines in use on the road, with weight of floor, is 40,000 pounds at each stringer bearing, the strains computed therefrom being as follows:

Flange strains at m, 3,800 pounds per square inch.

At a, 5,700 pounds per square inch;

At b, 6,400 pounds per square inch.

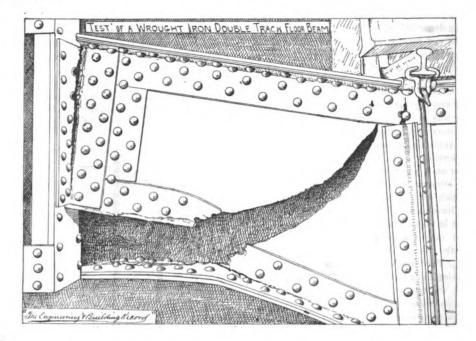
Shear strains in web, between a and b, 2,600 pounds per square inch.

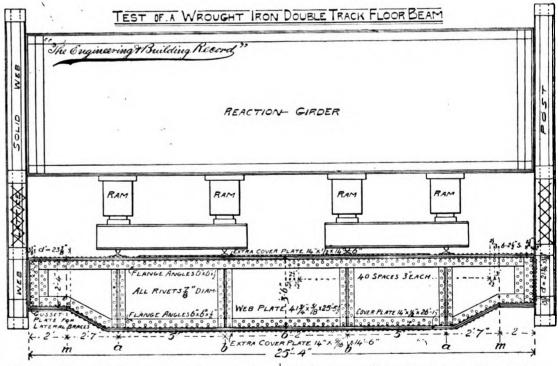
Shear strains in web, between a and end, 8,000 pounds per square inch at least section, or where web is 2 feet 4 inches deep, or 42 diameters between angle-iron.

RIVETS.

All rivets $\frac{7}{8}$ -inch diameter or $\frac{1}{2}$ when driven to fill holes; area of section 0.6 square inch; bearing-area, diameter \times $\frac{3}{8}$ plate = 0.35 square inch, and for $\frac{1}{2}$ -inch plate 0.47 square inch.

the test with the beam blocked up horizontal on the ground, so that the weight of the beam is necessarily neglected. The beam was connected with a pair of posts, precisely as in the actual structure, between which an additional girder was framed as a reaction base for the rams. The annexed diagram shows the general arrangements. The hydraulic power was derived from the testing-machine plant of the Keystone establishment, and the deflections measured from a fine wire parallel to lower flange, and about three inches therefrom. The diameter of the ram





Post attachment, considering all the 26 rivets doing duty, yields rivets strain as follows: In shear (single), 5,000 pounds per square inch, and bearing area (½-inch plate), 6,600 pounds per square inch.

Connection of 3/8 web to flange angles.—Taking the 40 rivets between ends of girder and second stringer, the horizontal strain difference is 162,000 pounds, the rivets being strained 3,400 pounds per square inch double shear, and 11,600 pounds per square inch bearing area. Taking distance from ends to first stringer, the horizontal strain difference is 105,000 pounds, yielding on 20 rivets, 4,200 pounds per square inch double shear, and 15,000 pounds per square inch bearing area.

Taking a short distance of two feet from ends, the horizontal strain is 70,000 pounds on 10 rivets, giving 5,800 pounds per square inch double shear, and 20,000 pounds per square inch bearing area.

In these girders the weakness feared was in the end flange riveting, and shear in end web, and caused the test recorded below.

The test was recently made at the works of the Keystone Bridge Co., by means of hydraulic power applied at stringer points; convenience made it necessary to make was ten inches. (Area 78.54 inches). The record was as follows:

	LOAD ON			
GAUGE	EACH RAM.	DEFLEC	TIONS.	TOTAL LOAD
READING.	Pounds.	В	6'	Pounds.
565	44,375	1/8"	1/8"	177,500
1,130	88,750	18	16	355,000
τ,412	110,900	3/8	3/8	443,600
No	permanent set in al	oove.		
1,695	133,125 unce	rtain.		532,500
Per	manent set scant 1	of an inch.		
1,980	155,500 not r	ecorded.		622,000
Per	manent set 5 of an	inch.		
2.080 Fail	ure commenced.			653,500

Failure commenced through giving way of angle-irons, beginning in a fine seam at first bend in lower flange from end support, the seam being along the root of the angle, which continual pressure tore apart across the angle as shown, when the web commenced to tear like a sheet of paper, in direction and manner as exhibited on plate herewith (from photograph). From some cause, not apparent, the deflections were not similar at the symmetrical end rams (a) the point where the web failed (left side) being sharply deflected. While the angles showed root fracture

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^{*}Abstract of a paper read before the American Society of Civil Engineers, November 16, 1887.

at the opposite point, the web did not fail or show indications of so doing, the deflection being on an easy curve. With the extreme vielding of the lower flange angles, the angle brackets connecting girder with posts commenced to go, tearing likewise along the root, and stripping the heads from the extreme upper rivets as shown. The internal diaphragm connecting the channel sides of the posts was

The rivets connecting the ruptured flange with web appeared as perfect as when driven, and no indication was disclosed, as far as it was possible to tell, of the holes in the web elongating or any upsetting of bearing surface. There is no telling what the web and rivets would have borne had not the solid angle-irons given way at the first bend.

It is to be noted that flange-plate with leg of angle attached thereto was intact, showing no indication of rupture.

Discussion .- Taking that stage of the experiment when a permanent set was first noted—viz., $\frac{1}{82}$ of an inch—the recorded load was 532,500 pounds, or as near as may be 31/3 times the basis on which the calculations in the first part of this paper were made (40,000 pounds on each stringer, or 160,000 pounds total). Applying this ratio to the preceding computations, the iron would be apparently strained as follows:

When failure in angles was first noted, the recorded load was 653,500 pounds, or slightly more than four times the computed basis of load, which would increase the above strains about one-fifth, giving a calculated flange strain when angle failed of some 15,000 pounds per square inch, and bearing-area strain on end flange and web rivets about 80,000 pounds per square inch, neither of which could possibly be true, or the web would have torn out from the rivets, and the flanges be perfectly sound, well within elastic limits, although in the last case it is to be noted that the horizontal table of the flange was perfectly sound, the flange failure commencing primarily with a long split along the weld of the angle-iron root, throwing the whole flange duty upon the vertical legs of the angle-irons when a rupture strain was quickly reached. Had the angles been rolled from a solid ingot, or on the German method of developing from a flat instead of from the ordinary welded pile, the strength of this beam would have been largely increased. The prime weakness in this beam was due therefore to the mode of manufacturing the angle-irons, which were weak along the weld at the root. This was also shown in the end bracket-angles uniting the beam to the posts."

The writer deduces from this experiment that a plateweb is an exceedingly stiff member, much stiffer than is commonly supposed; that the customary method of proportioning rivets-viz., the horizontal component between any two given points divided by allowable bearing pressure per square inch equals number of rivets requiredis not true, and that the friction due to power riveting has enormous value.

This beam was reported to the company interested as practically safe by the writer, on general considerations, before the experiment was made, and the opinion reaffirmed after the experiment.

The paper was discussed by Theodore Cooper, who stated that the girder was not properly proportioned, as the ends of the beam in this design would be required to bear double the amount of strain it should bear, and the centre of member only one-half the amount.

He did not consider it defective in the strength required, but a better design could be constructed without increasing the cost. In computing the strains for bridge members the practice of French engineers was to consider the friction of rivets, but this friction was ignored by both English and American engineers. Mr. Brown followed by stating that in present practice we do not like to use a beam of this design; that there was not iron enough in the ends of web to resist the strains. It was also discussed by Messrs. Buck, Dagron, Devin, Buckholtz, Emery, Lindenthal. Pegram, and Lucius. The illustrations show a 'bird's-eye view of the beam as arranged for testing and an enlarged view of the fracture taken from a photograph.

PAVEMENTS AND STREET RAILROADS. No. XXI.

(Continued from page 7.

WOOD PAVEMENT IN THE METROPOLIS.* CORRESPONDENCE (CONCLUDED).

WITH reference to the number of experiments of the cement which he had made for the author, and which had cement which he had made for the author, and which had been published in their entirety, he should like to say that in every case he sent his report to the author on the completion of the seven days' test, and that therefore the extracts from these reports, which were given in the paper, were not to be considered as defining the nature of the cement as shown by future experiments, but simply as his opinion of the cement at that date. No doubt a finer ground cement would have been preferable, and would probably have enabled the author to obtain the strength he required with the larger proportion of aggregate—viz. e required with the larger proportion of aggregate—viz., to I instead of the 5 ½ to I which he found it necessary o use, and would therefore have resulted in economy; otherwise the cement was of good quality and well suited

to the purpose.

Mr. A. Southam observed that his experience as surveyor for the Wandsworth Board of Works at Clapham, enabled him to confirm the author's conclusions. In Octo-ber, 1880, the High Street Clapham was paved with wood by the London Tramways Company and the Wandsworth Board. In the centre of the road were two lines of tramway; these had been previously paved with several kinds of asphalt, and all had failed; the margins of the carriageof asphalt, and all had failed; the margins of the carriage-way were macadam. The tramway was paved under the direction of the engineer to the company, with plain deal blocks grouted with cement; the margins, 3,600 square yards, were laid by the Improved Wood Paving Company for the Wandsworth Board with blocks dipped in creosote on a bed of 6 inches of concrete, composed of Thames ballast and Portland cement, in the proportion of 6 to 1, at a cost of 11s. per square yard. The excavation was undertaken by the Wandsworth Board; the value of the macadam somewhat exceeded the cost of breaking up, carting, and sifting it for use elsewhere. The pavement had been maintained by the Improved Wood Company free of cost for three years, when they expressed their willingness to for three years, when they expressed their willingness to enterinto a contract to maintain it for a further period of fifteen years at 10d. per square yard per annum, and to leave it in good order at the end of that term; but although that was considered a small sum the board had thought it desirable to maintain it themselves. Both the pavement laid by the Improved Wood Paving Company and the laid by the Improved Wood Paving Company and the Tramway Company were in good order, no repairs having yet been required, and the work had been done nearly four years. In any extension of wood-paving he would use plain well-seasoned yellow deal wood blocks grouted with Portland cement, laid on concrete, formed of the old macadam, sifted and mixed with Portland cement. He considered that it was expedient to have large works executed by contract, but the maintenance should be undertaken by the parish authorities who had the control of the road.

Mr. G. F. White expressed his satisfaction with the paper, which he thought was a valuable supplement to those of Mr. Deacon and Mr. Howarth. Considerable experience had been gained in the intervening five years as to the endurance of wood as a pavement. The statistics collected by the author should help, he thought, to set at rest many questions on which opinions were divided some years back. There were two points on which he desired to offer a few remarks. The first related to the character of the foundation to be used under the wood. The second, to the mode in which the blocks should be laid with reference to one another. It seemed now to be quite agreed that the indispensable condition of securing a good and lasting paving was a firm and unyielding foundation, and it was also conceded that no material was so fit for this purpose as concrete made of Portland cement and gravel, in the proportions of I part of cement to 5 or 6 parts of gravel. The author seemed to be of opinion that a thickgravel. The author seemed to be of opinion that a thick-ness of 6 inches was sufficient for all purposes. Mr. White concurred in this view where the soil under the concrete was hard and undisturbed; but where the ground had to be picked up to provide for gas or water pipes, as was so generally the case, he thought the layer of concrete should not be less than 8 to 9 inches, especially in thoroughfares where the traffic was heavy. He had noticed in certain cases, and especially in Pall Mall, where the wood paving was probably in a worse condition than in any street in London, that the excavation for the concrete base had been very unequal in depth, the sub-stratum having in some cases been hardly removed at all, while in other parts there were holes 12 and 13 inches deep, which had been filled up with hard rubbish; and over this surface had been laid a bed of concrete, averaging hardly more than 3 inches in thickness. Such a mode of proceeding could only have one result, which had been predicted while the work was in progress—namely, the speedy breaking up of the pavement, with the namely, the speedy breaking up of the pavement, with the consequent necessity of replacing it within a year or two. As a matter of fact that was what happened. The paving showed signs of subsidence almost immediately; and though the middle of the roadway had been in part relaid, the generality of the work was in as bad condition as ever. The author had mentioned two cases in which the concrete had been laid 12 inches thick, and though in the one case (Regent Street) the advantage had been nullified by the inferior quality of the wooden road laid upon it, it was to be inferred from the description of another example in Parliament Street

*Appear by George Henry Stayton, Assoc, M. Inst. C. E. and

*A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.

that the life of the wood road would, in the author's estimation, be considerably increased by the extra solidity of the deep foundation. From a careful consideration of the whole question, Mr. White had come to the conclusion (1) that the concrete should in all cases have a thickness sufficient to make it act as a beam in bridging over these inequalities of excavation. (2) That the life of the wood inequalities of excavation. (2) That the life of the wood was in direct proportion to the immobility of the foundation, which must be deep enough to resist from the first the hammering action of horses' hoofs and the heavy pressure of wneels. The second consideration to which he would advert, was the way in which the blocks should be laid together in the roadway, and which resolved itself practically into a question of joints, or no joints. Now in the various pavings reported on by the author every sor of jointing seemed to have been tried, and though he had judiciously abstained from dogmatically asserting his judiciously abstained from dogmatically asserting his opinion, lest he should perchance be regarded as the paropinion. lest he should perchance be regarded as the partisan of any particular system, there seemed to be little doubt that he had a strong preference for laying the blocks together as closely as they could be put, and filling in the interstices with Portland cement grout. In this view Mr. White heartily concurred, and was glad to find it was also the opinion of Mr. Howarth. He believed that the use of grooves or wide joints, as affording foothold for horses, was of very doubtful advantage since when the paying was of very doubtful advantage, since, when the paving was perfectly dry or thoroughly wet, the foothold was complete, even with a jointless material like asphalt; and when plete, even with a jointless material like asphalt; and when the pavement was in the intermediate state of slipperiness, caused by frost or London fog, the grooved paving gave no more support to horses than did the close joint, the reason being that the mud filling of the joints, taken in connection with the rounded edges of the blocks, was rather a cause than a preventive of slipperiness, which was altogether absent in the case of the continuous paving. Another argument against setting the blocks apart was the fact that their being so set helped the abrasion and rounding of their arrises, which was not only in itself an element of deterioration, but tended after a time to create a sort of corduroy road, on which the wheels bumped from one block to another, producing thereby a jar very detrimental to comfort in driving over it. If any proof were needed of the correctness of this statement, one had only to drive in Oxford Street, over the road running from the Marble Arch eastward, to feel the difference in smoothness and comfort of the close-jointed pavement in comparison with the grooved and bumpy road which succeeded it further Mr. White had been told by omnibus drivers, who were

excellent judges, that if the wide-jointed pavements were universal in London streets, there would not be a driver without a spinal complaint at the end of a twelvemonth. As regards the direction in which the blocks should be laid in relation to the street, there would seem to be laid in relation to the street, there would seem to be no doubt that it should be transversely to its length, like ordinary stone paving. In the paving before referred to in Pall Mall, the blocks had for some inscrutable reason been laid diagonally, than which nothing could be imagined more unsafe for horses, or more predjudicial to the comfort of those who drove over them, especially when the joints were, as in the case of one exhibited, 1½ inches in this particular payment appeared from in thickness. This particular pavement appeared from the author's statement to have been constructed at a cost the author's statement to have been constructed at a cost of about 8s, per square yard, about one-half the price at which most other roads had been laid. It was in his knowledge that the expense of making it had been largely subsidized by the clubs and the War Office, who had not taken the ordinary precaution of employing an inspector to watch its construction, but had left it entirely to the parochial authorities, of whose parsimony and ignorance it remained unhappily a convincing proof. It was to be hoped such a state of things would not easily recur, though he was not without fear that the neighboring roadway of hoped such a state of things would not easily recur, though he was not without fear that the neighboring roadway of Cockspur Street and Charing Cross, quite recently laid, would manifest before long the consequences of insufficient foundation. This led him to inquire whether it was impossible to institute some more authoritative control than at present existed over the construction of the wood roads of London. The information gathered by Mr. Howarth and by Mr. Stayton was as ample and specific as would have been collected by a select committee sitting on the question, and must surely therefore be sufficient as a guide to some uniform plan for select committee sitting on the question, and must surely therefore be sufficient as a guide to some uniform plan for the execution of such works. The question then became whether such uniformity could be enforced on the different parochial bodies of the Metropolis. The roadways were for the comfort of the whole community—not of individual parishes; and he could heartily wish that such a body as the Metropolitan Board of Works, which seemed to have most things under its management, could actively inter-vene to give the ratepayers the benefit of the investigations which had been made on the subject, instead of leaving them any longer to be the victims, both in pocket and in comfort, of every experimenter who might have a nostrum to recommend or a patent to push.

Mr Stayton, in reply to the correspondence, remarked

that such observations as those made by Mr. Culver-well were extremely practical and valuable. He, how-ever, felt compelled to reassert his opinion that the pitch-pine blocks in King's Road created an unpleasant 'jarring' motion when driving over them. He had many times experienced it, and on a recent occasion the effect was very apparent. Possibly this evil could be mitigated by the application of Henson's felt bed and joint. He was glad that Mr. Culverwell had so clearly expressed his reasons for declining to support the creosote theory, feeling convinced that the extra cost of creosoting could be better expended in the selection of the timber. He concurred



in Mr. Delano's objection to the terms "asphalt" and "asphaltic" as applied to the wood pavement laid by the Asphaltic Wood Pavement Company; obviously the British asphalt used by them was a manufactured article, and the name might lead to confusion. Where the word "asphaltic" appeared in tables, it merely referred to the "Asphaltic" Company's system, in the same way that "Henson's" or the "Improved" systems had been referred to. He did not find that the wood in Chelsea "gave off poisonous emanations under a hot sun," although it had been laid 5½ years; this fact, however, could be accounted for, because its surface was thoroughly watered and machine-swept twice a week during the summer, independently of the attention described under the heading of management. Any neglect of this service, however, would soon create the unpleasant condition described. He assumed that it would be taken for granted that the thickness of concrete foundation referred to by Mr. White (six inches) would only be adopted where the soil was hard and undisturbed, and he could refer to numerous instances in the Chelsea pavements where the thickness from 8 to 10 inches; in fact, a depth of 12 inches had been laid for a long distance over the site of a suspicious gas trench in Sloane Street.

(To BE CONTINUED.)

AN ELECTRIC TIDE-GAUGE.

La Lumière Électrique describes an electric water-level indicator and recording apparatus made by C. & E. Fein, of Stuttgart, which, it is claimed, affords a simple means for making daily observations of the level of rivers, tides, etc. It consists of a float which is placed in the bottom of a closed cylinder which communicates with the body of water by means of a spiral tube so as to avoid all irregularities by the motion of the water. The float is connected with a pointer which revolves in front of graduated circle and indicates the height of the water. The axle of the pointer controls a pencil connected with the recording device. This device consists of a drum carrying ruled paper, whose vertical lines indicate intervals of fifteen minutes, while the horizontal lines equal intervals of one decimeter, indicating height of water-level A pencil controlled by an electro-magnet is moved by operation of the clock movement from left to right over the paper. At every fifteen minutes the clock movement also operates to close circuit and actuates the electro-magnet, which then causes the pencil to make a dot on the ruled paper. The paper on the drum is ruled for 27 hours and must be changed daily. The dots show the variations in the water-level in the form of a curve. The entire apparatus (except the float and its cylinder) is in an ornamental box. The dial shows the height of the water by inspection at any time. The ruled paper serves for a record

A WATER-TOWER FALLS AT THOMASVILLE, GEORGIA.

A DISPATCH to the New York Herald indicates that the epidemic of disasters to water-towers has not yet ceased, and, as we warned our readers a short time since, the immunity from personal disaster that has thus far obtained could not be expected to continue. A water-tower in process of erection at Thomasville, Ga., fell on the 6th inst., instantly killing four men, among them the contractor, J. P. Rommerdall, and seriously injuring four more.

The masonry intended to support the tank had reached a height of about seventy feet, when the removal of some bracing permitted the vibrations due to the hod-elevator to overthrow the central pier, some six feet in diameter, which in its turn destroyed the outer wall and the surrounding scaffolding.

It will be remembered that the jar of the hod-elevator was also the proximate cause of the fall of the Harlem school-house, in this city, by which seven men were killed. Perhaps the hod-elevator may be a blessing in disguise, serving to test the stalility of a structure during erection, and thus, perhaps, preventing a more serious disaster later on, for it does not seem as if any properly constructed edifice would be destroyed by such a cause.

THE St. Louis Daily Globe Democrat of the 4th inst. contains a long and very fully illustrated popular article on the manufacture of illuminating gas, which will be interesting and instructive to gas consumers, and perhaps restore some of their lost confidence in the gas companies and their mysterious and much-suspected representative, the gas-meter.

SOME DETAILS OF WATER-WORKS CONSTRUCTION.

No. V.

(Continued from Vol. XVI., page 710.)
BY WILLIAM R. BILLINGS, C. E.,
Superintendent of Water-Works, Taunton, Mass.
HYDRANTS, GATES, AND SPECIALS.

STREET intersections are obviously suitable places for hydrants and gates.

A hydrant so placed serves more territory than one placed in the centre of a street line, and at the intersection of important thoroughfares and large mains the four-way hydrants carrying four hose-nozzles are in every way suitable, if post-hydrants are chosen.

For the narrow crowded streets of a large city the flush hydrants are better than the post, but, as a rule, the small water-works which have sprung up all over the country during the last few years are fitted with hydrants of the post pattern.

If a post hydrant is not placed near a street corner, it is well to put it on a division line between two estates, for the chances that it will in the future be an obstruction are smaller in this position than they can well be in any other. The distance apart for hydrants may be 200 or 500 feet, according to circumstances, but the larger distance should not be exceeded without the best of reasons.

It has become a well-established custom to place gates on street lines, and the ease with which gates so placed can be found is a sufficient reason for not departing from the custom except in some special cases. In unpaved streets a gate-box located at a corner on a street line may be a source of trouble if the travel about the corner is considerable, for the wearing of the road will soon leave the box projecting above the surface to a dangerous extent. In cases where this condition of things is likely to obtain, the writer has thought it wise to move the gate ten feet away from the street line, and it is fair to ask if a uniform distance of ten feet would not have some advantages over a strict adherence to street lines.

The superintendent or the engineer or his assistant should follow the pipe-laying gang closely enough to locate every gate and special before it is covered by the back-filling gang. If one should perchance miss the location of something, he will be both surprised and amused to see how wild and yet how confident will be the guesses of a bystander who saw the gate covered the day before, and then tries to assist one in finding it.

In locating and making notes for future reference, a little judgment is required to enable one to choose permanent and easily found landmarks.

Fences and stone-bounds come first, as a rule, and the post-hydrants furnish excellent measuring points. Lampposts are reasonably permanent, but trees and hitchingposts illustrate the "mutability of human affairs" of Dominie Sampson. A rough sketch, with no regard to scale, will be found more intelligible after sixty days than a written description.

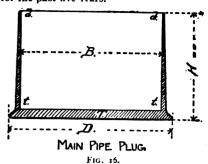
As a rule, it does not pay to build gate-boxes so that a man can get into them to oil and pack the gates. In paved streets, where digging is both expensive and inconvenient for the public, large brick manholes are of course demanded, but for town and country the cast-iron gate-boxes, well known to the trade, leave little to be desired.

The writer has heard of main-pipe specifications which called for a bed of concrete under each gate and hydrant. Under a hydrant in wet uncertain ground it may have some value, but under a gate there seems to be no call for it; indeed, it may be a source of trouble should the pipe settle a little and the gate be unable to follow. When a hydrant is placed in an ideal manner, it has a firm foundation in a large flat stone or good earth, good backing of stone or well-rammed earth, and perfect drainage. If a sewer is not available, fair drainage may be secured by surrounding the base of the hydrant with broken or round stone, provided the ground has any absorbing power, and in clay, a small well may be sunk at some distance from the hydrant, enough below it, and of sufficient diameter to contain three or four times as much water as the hydrautbarrel will hold. A small drain is then run from the hydrant to the well and the well is pumped out as often as need be.

Frost-jackets seem to be going out of fashion. Without doubt they have little value in sandy or gravelly soils. In clay the action of the frost may be expended on the jacket and so save the barrel some straining, but men of experience are not wanting who declare that frost-jackets should fall into "innocuous desuetude,"

As a rule, the plugs for main-pipe furnished by the foundries are unnecessarily heavy, unless made from special patterns.

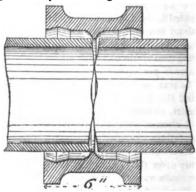
In Fig. 16 is shown the pattern adopted and used by the writer for the past five years.



The following table gives the dimensions for plugs to be used with four, six, eight, and ten inch pipe:

Size of Pipe.	D	В	н	Т	t	ď
4 6 8	5¼ 7¼ 9¼ 11¼	4 6 8 10	6 6 6	% % %	KKKK	XXXX

The sleeve shown in Fig. 17 differs from the ordinary pattern only in having an inside rim which furnishes a support against which the joints can be made. The diameter of this rim should be fixed with some care and with reference to the outside diameter of the pipe with which the sleeve is to be used; for unless the sleeve will slip over a pipe from which the spigot end has been cut, the chief advantage of this special casting will be lost.



MAIN PIPE SLEEVE FIG. 17.

Sleeves are all but indispensable in bringing two parts of a pipe-line to a junction between two rigid points, and they may be found useful in assisting one to use up pieces of pipe without bells. Some foundries make their special castings with bells all around, while others send out their single and double branches, with spigots on one end of the main run. The writer has found the "bells all round" pattern to be the most economical in the way of using up the pieces, but on every job of magnitude cases will arise in which the spigot-end special will save cutting pipe-

If practicable, main-line junctions should be made with specials a size or two larger than the pipe—that is, two 8-inch lines may cross each other at right angles, though a to-inch double branch, and the New Bedford pipe plan by Mr. Coggeshall, given in a previous chapter, furnishes another case in point.

BACK-FILLING.

The best possible work in back-filling a trench is done with water, but oftener than not, perhaps, we must be content with ramming and tamping the dry earth. If time enough is put into it, and there is only one man shoveling to each man with a tamp, good work can be done without water, but such a method is expensive and with contractors, as a rule, it is not in favor. The best results with dry earth are obtained when the dirt is spread evenly in layers, not more than six inches thick, and each layer is thoroughly tamped and trodden before another is added.

If he works as he should the man in the trench will find the pounding and treading harder than shoveling, and to even things the shoveler and tamper may change places several times during the day. If water is used it should not be in such excess as to make "pudding" in the trench, and the amount of wetting must be proportioned to the absorbing power of the filling. The water does its work by carrying down the fine particles of earth as it soaks away, and more than enough to do this thoroughly is not

If the trenching has been properly done, the top of the street—that is, the good gravel, or the macadam—has been put by itself on one side and should be raked over, been put by itself on one side and should be raked over, and the stones and fine material separated; the stones to be put in just under the surface which is to be finished with the fine material. The amount of crowning to be given the top of trench should depend upon the thoroughness with which back-filling has been done, the size of the pipe, and the character of the soil. If a trench has been well filled a rise of six inches is ample, and if this does not settle down even with the road after one or two hard rains

Pipes should be filled slowly and carefully, because under certain conditions great damage may be caused by too rapid filling. A long line should be filled one section at a time, and no gate before an empty section should be fully opened until positive evidence can be had that the section is filled. If the line to be filled carries hydrants, the air can be allowed to escape through them, but if these outlets cannot be had air cocks on the sumbut if these outlets cannnot be had air-cocks on the summits are necessary.

A special form of air-cock can be had in the market, but

for ordinary use any convenient form of corporation cock may serve the purpose by arranging a lever handle and a

was thought best to discuss them together. (Abstracts

of papers will be given hereafter).

Mr. C. J. H. Woodbury, of Boston, spoke of two improved methods of heating; first, that just mentioned, in which a blast of air is forced through coils of steam-pipe into the space to be heated. This method, he said, took less steam-pipe and could be better regulated than the radiator system. He then referred favorably to the overhead system, in which the pipes are suspended from the ceiling. This, he said had been ridiculated at first, but were residily explained. he said, had been ridiculed at first, but was rapidly gaining

ground.

Mr. Daniel Ashworth, of New York, then spoke on the subject of the power required for driving blowers, which, he said, was far higher than the lists of makers of blowers would indicate. He also stated that closing the outlet aperture of fan-blowers decreased the power required to drive the blower

Professor J. E. Denton, of Hoboken, differed from Mr. Professor J. E. Denton, of Hoboken, differed from Mr. Ashworth, and believes that the tables of power needed for fans, as published by Sturtevant, are correct. He also thinks that positive blowers are better for strong blasts than fan-blowers. The cost of the lacing of belts is a considerable item in fan-blowers.

Mr. William F. Mattes, of Scranton, said that he had tried first Sturtevant blowers, then Baker blowers, without satisfaction: finally, by getting larger Sturtevant blowers.

satisfaction; finally, by getting larger Sturtevant blowers, obtained good results. He therefore thought that many condemned them, as he had, when they did not have large enough ones.

Fan-blowers, he said, cost less, and with them there

was less waste from leakage in the pipes.

Mr. Schuhmann then pointed out a difference between positive and fan-blowers in the fact that a reduction of area of outlet increased the requisite driving power with positive blowers, while it decreased it with fan-blowers; therefore fan-blowers are more economical than positive,

therefore tan-blowers are more economical than positive, if run very often below full capacity.

E. C. Felton, Penn Steel Co., said the Penn Steel-Works started with Sturtevant blowers, but afterwards took them out and put in Baker blowers. He thinks positive the started blowers are more economical than positive. itive blowers are better for pressures of twelve ounces and

upwards.

R. H. Thurston, Cornell University, thought proper account had not been taken concerning the best shape of blade, and says that though they should be curved, the curvature is often too great, and that the proper curvature is dependent upon several conditions, chiefly upon the speed of revolution. He cited a case where a fan running in the wrong direction had failed to give any perceptible

pressure.

Mr. W. B. Le Van, of Philadelphia, Pa., then, in a few remarks referring to both papers, showed his approval of the method of heating offered by Mr. Snell, and cited the fact that it ventilated as well as heated.

Professor Denton arose to defend Rankine's formula for the curvature of the blade, and said that no experiments had been sufficiently well carried out to disprove its correctness, even if they seemed to point that way.

ments had been sumcerely wen carried out to disprove its correctness, even if they seemed to point that way.

Mr. Snell then arose in favor of positive blowers with about the same reasons as given by Mr. Schuhmann. He opposed the idea of there being any marked difference in

opposed the idea of there being any marked difference in efficiency due to shape of blades.

Professor R. H. Thurston's paper on "Internal Friction of Non-Condensing Engines" came up next. It was discussed by J. E. Denton, H. R. Towne, Samuel Webber, and William Kent, all of whom agreed very nearly with the paper, and the general conclusion was that the friction was about constant under varying loads.

Mr. Oberlin Smith, of Bridgeton, N. J., then presented his paper on "Power-Press Problems," which was discussed by Messrs. Grant, Lewis, Stiles, and Coffin.

In the afternoon different parties visited several points.

cussed by Messrs. Grant, Lewis, Stiles, and Coffin.

In the afternoon different parties visited several points of interest to the profession, the most prominent of which were the works of the following companies: William Cramp & Sons' Ship and Engine Building Co., where the following work on hand was examined:

U. S. Cruiser "Baltimore."—Length, 335 feet; breadth, 48½ feet; mean draught, 19½ feet; tons, 4,400; horizontal, triple expansion, twin-screw engines; four double-ended tubular boilers, 135 pounds steam; 9,000 indicated horse-power.

brose-power.

U. S. Gun-Boat No. I (no name.)—Length, 230 feet; breadth, 36 feet; mean draught, 14 feet; tons. 1,700; horizontal, triple-expansion, twin-screw engines; four cylindrical locomotive boilers, 160 pounds steam; 3,000 indi-

cated horse-power.

U. S. Pneumatic Dynamite-Gun Boat (no name.) Length, 246 feet; breadth, 26½ feet; mean draught, 8½ feet; tons, 700; three 15-inch guns; vertical, triple-expansion twin-screw engines; four cylindrical locomotive boilers, 160 pounds steam; 3,500 indicated horse-power; speed, 20 knots.

Machinery for Steamboat "Connecticut," Stonington Line.—Diagonal compound side-wheel engines; six cylindrical locomotive boilers, 110 pounds steam; 5,000 indicated horse-power.
Steamboat for Central Railroad Company of New Jersey,

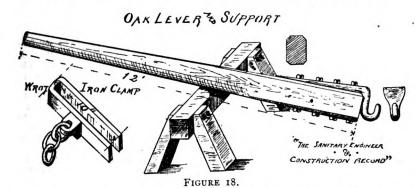
Sandy Hook Route.—Length, 250 feet; breadth, 35 feet; mean draught, 10 feet; vertical triple-expansion, twinscrew engines; four return tubular boilers, 160 pounds

steam; 2,500 indicated horse-power.

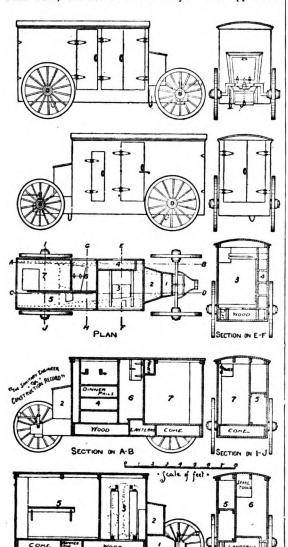
U. S. Cruiser "Newark."—Length, 310 feet; breadth, 49 feet; mean draught, 18½ feet; tons, 4,083; horizontal, triple-expansion, twin-screw engines; four double-ended return tubular boilers, 160 pounds steam; 8,500 indicated

brise-power.

U. S. Cruiser No. 4 (no name.)—Length, 335 feet; breadth, 48½ feet; mean draught, 19½ feet; tons, 4,400;



it will have to be cut down if the road surveyor does not want to wait for wear and tear to level it. Some contractors prefer to fill without much tamping, crown the trench a foot, and then either repair the road after a month or two or deposit with the superintendent of streets a sum large enough to cover the cost of repairs. If sand has been taken from the trench it will ruin any road if allowed to come near the surface by working up through a thin been taken from the trench it will ruin any road it allowed to come near the surface, by working up through a thin layer of good road material. If sheet piling has been used it may be removed after the trench is half fi!led by means of a clamp and lever shown in Fig. 18. A 4x6 stick, a piece of chain, and a pile of blocks may be made to do the same work, but not so conveniently. The apparatus



shown in Fig. 18 is copied in part from a blue print presented at one of the meetings of the New England Water-Works Association by Mr. William B. Sherman, M. E., of Providence, R. I. The horse should be well braced with iron rods, and may be protected on top by a plate of light tank-iron.

SECTION ON C-D

blow-off pipe to be operated at will. In concluding the main-pipe division of his subject the writer presents in Fig. 19, sketches of a tool wagon for use in main-pipe or sewer construction. The drawings are made from blue prints presented by Mr. R.C. P.Coggeshall, Superintendent of the New Bedford, Mass., Water-Works, at one of the meetings of the New England Water-Works Association.

TOOL-WAGON.

R. C. P. Coggeshall, Superintendent, New Bedford Water-Works.

This tool-wagon was planned by Mr. Ashley, foreman of this department, and was built by the regular employees during the winter months, at intervals whenever an hour or two could be spared. The cost as given below would in consequence probably exceed the amount at which this tool-wagon could be built by contract.

ESTIMATE OF COST. ESTIMATE OF COST. Set of wheels and pole. \$31.00 Axies \$10, bolts \$3... 13.00 Door-pulls, 50c., 4 bolts \$1.40 1.90 6 pair hinges \$1,4 pair back-flaps 40c 1.40 7 pair strap-binges \$1.33, 1 doz. hooks 60c 1.93 3 chain bolts 90c., 10 feet chain \$1. 1.90 Screws \$4.16, nails \$2.15 6.31 303 feet 1-inch matched pine, planed 15.58 153 "spruce 3.52 130 feet 2-inch spruce, planed 2.33 Blacksmithing 30.49 Labor and painting 105.00 Amount\$214.36 CONTENTS. Goose-neck, Paving-pounder and hammer, 3 stone chains, 3 wheelbarrows of wood, 2 buckets of clay,

4 sets of lead and gasket irons,
4 drailing hammers,
1 stone hammer,
2 dozen cold chisels,
6 diamond points,
6 cutting-out irons,
12 joint wedges.

- 4 lengths hose. 40 picks and shovels, 3 stone sledges, 6 striking hammers, Hydrant key,

20 dinner-pails. Tackle, Nails and Hammers. Small locker for spare tools, Plug drill box, 9 lanterns and oil-can.

6-toot measuring-stick.

Can, powder and fuse, 3 hoes, coil gasket, 6 pigs lead, furnace, 2 barrels coke, lead kettle and spoon, bell pole, saw, tamping bar, 12 buckets, 6 lantern sticks, 4 iron bars, 14 blowing-drills.

(TO BE CONTINUED.)

ANNUAL MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE eighth annual meeting of the American Society of Mechanical Engineers was held in Philadelphia at the Continental Hotel, from November 28 to November 30,

The opening address, by the President, Mr. George H. Babcock, of New York, was a carefully prepared and scholarly production, and it is a matter of regret that it is impracticable to reproduce it here.

It eloquently referred to engineering as a divine commission from God given in the command to our first parents to "replenish and subdue the earth," the latter part of which has been largely the work of the mechanical engineer.

Professor John E. Sweet's paper on "A New Principle in Steam-Piston Packing" was then taken up and discussed by Messrs. William Kent, De Volson Wood, George S. Strong, Frank H. Ball, Angus Sinclair, George H. Babcock, Daniel Ashworth, Thomas R. Almond.

Tuesday morning's session opened with the reports of the committees, which, all told, showed the society's affairs

the committees, which, all told, snowed the society's affairs to be in a most prosperous condition.

Following this the first papers taken up were those of Mr. John I. Snell and Mr. Henry I. Snell, and as the first was on "Experiments and Experiences with Blowers," and the second on an "Economical Method of Heating and Ventilating an Office and Warehouse Building," which was by the use of blowers driving air through steam-coils,

horizontal, triple-expansion, twin-screw engines; four double-ended return tubular boilers, 160 pounds steam; 9,500 indicated horse power; speed, 19 knots.

Total indicated horse-power on hand, 41,000

At the I. P. Morris Company the following of the plant designed by E. D. Leavitt, Jr., for the Calumet and Hecla Mining Company, and now approaching completion, was examined with much interest:

Hoisting-engines, "Houghton and Seneca."—Triple-

Hoisting-engines, "Houghton and Seneca."—Triple-expansion, direct hoisting beam-engines, cylinders, 18 inches, 27¾ inches, and 48 inches diameter, 7 6" stroke; boiler-pressure, 180 pounds; shafts, links, connecting-rods, and crossheads of crucible steel, made by Krupp.

Hoisting-drums for above engines.—Two drums, large, diameter, 25'9", small, diameter, 14'3", length, 12 feet, to be turned and grooved for 5,466 feet of 1¾-inch rope. Shafts for drums, 22½ inches in diameter, 29 feet long, weighing 32,000 pounds each.

Clutch fly-wheels.—Two wheels of 30 feet diameter. Total weight of engines, including drums, shafts, flywheels, and outboard pedestals, about 800 tons.

Air-compressors.—One pair coupled air-compressors, plungers, 42 inches diameter, 60-inch stroke, driven by spur gearing with cut teeth, wheel, 20 feet diameter, 30-inch face, mortise pinion, 10 feet diameter. Total weight, 250 tons.

250 tons.

Steam stamps.—Six stamps, cylinders, 21 inches diameter, valve gear driven by belting. (For description, see "Transactions of the American Society of Mechanical Engineers, Vol. VI., page 370.)

Locomotive boilers, Belpaire type.—Six boilers, diameter of chell considers, total length.

Locomotive boilers, Belpaire type.—Six boilers, diameter of shell, 90 inches, total length, 34'4", extreme width, 10'4½", height, 8'9", 199 3"x16' tubes. Working pressure of finished boilers, 135 pounds, and shipping weight 74, 100 pounds each. Working pressure of incomplete boilers, 180 pounds; estimated weight, 85,000 pounds each. All of "Otis" steel. In addition to above there were in course of construction:

Hoisting-engine "Gratiot."—Same as engines previously described.

Pumping-engine "Michigan."—Cylinders, 18 inches,

Pumping-engine "Michigan."—Cylinders, 18 inches, 27¾ inches, and 48 inches diameter, 76 stroke, 2 pumps, differential plungers, 34 inches and 48 inches diameter, 76 stroke, the steam end of this engine being of almost exactly similar design to the hoisting-engines.

Hydraulic gear.—For operating clutches and brakes for hoisting-engines.

Drum indicator gear sharms

Drum indicator gear, sheaves, hangers, and shafts for

Drum indicator gear, sheaves, hangers, and shafts for leading hoisting rope, steam drums, steam pipe, stop-valves, etc., etc., steam chests, etc., of steel castings made by Thurlow Standard Steel Co.

The works of William Sellers & Co., the Baldwin Locomotive Works, the docks and coal yard of P. & R.R. R., where are the coal-handling appliances described in the paper by Mr. James M. Dodge, were seen in operation.

Tuesday evening's session opened with Mr. John J. Grant's paper on "The Milling Machine as a Substitute for the Planer." It was discussed by Messrs. Henry R. Towne, Charles Potter, Jr., J. B. Webb, J. E. Sweet, W. F. Durfee, J. T. Hawkins, none of whom differed in any marked degree from position taken in Mr. Grant's paper.

Mr. Frank Van Vleck's paper on "Standard Section Lining" was then taken up and discussed in a lively manner from several different standpoints by Messrs. F. R. Hutton, John J. Grant, Henry R. Towne, F. N. Will-

manner from several different standpoints by Messis. F.
R. Hutton, John J. Grant, Henry R. Towne, F. N. Willson, F. A. Halsey, John Coffin, J. B. Ladd, J. E. Sweet,
J. E. Denton and W. H. Weightman. The object of the
paper was the appointment of a committee for adopting a standard for section lining; it was, however, voted down by the society.

The next paper was by Mr. Percy A. Sanguinetti on "Divergencies in Flange Diameters of Pumps, Valves,

It was discussed by Messrs. Samuel Webber, F. W. Taylor, H. R. Towne, W. B. Le Van, W. H. Weightman, A. H. Raynall, William Kent, W. F. Mattes, J. T. Hawkins, J. E. Sweet, and E. F. C. Davis. The result of the whole being the appointment of a committee who should endeavor to bring about a uniform standard.

Mr. William O. Webber's paper was next read by Mr. Hutton on "Centrifugal Pumps and their Efficiencies," which brought out discussion from Messrs. R. H. Thurston, De Volson Wood, Hugo Bilgram, and J. E. Denton, in which it was agreed that they came under the same principles as blowers and that the shape of the vanes desended upon the speed of revolution. pended upon the speed of revolution.

Early Wednesday morning quite a party of engineers assembled at the Broad Street Station to take a train for Tacony by invitation of Henry Disston & Sons, at whose works they were shown much that was of professional interest, their method of compressing steel ingots and their new fuel-gas plant on the "Loomis" system attracting much attention

their new fuel-gas plant on the "Loomis" system attracting much attention.

On resuming the reading of papers that by Professor Gaetano Lanza on "Friction in Toothed Gearing" was first taken up, with discussion from Messrs. H. Bilgram, Wilfred Lewis, J. E. Denton, and J. T. Hawkins.

Professor Lanza then presented a second paper, the joint work of Jerome Sondericker and himself, on the subject of "Investigations as to How to Test the Strength of Cements," which elicited discussion from Willard P. Parsons, who noted that it was upon such ground as this that the work of civil and mechanical engineers approached that the work of civil and mechanical engineers approached

Mr. Parsons did not agree with Professor Lanza as to the amount of the effect of oblique direction of strains in testing, and he thought more importance should be

attached to the proper mixing of cements, and in the steady and constant application of the strains in testing.

Professor Denton asserted himself as agreeing with the paper. Professor Lanza then arose stating that all the

requirements named by Mr. Parsons had been strictly ful-filled in experiments to which he referred.

Mr. Parsons then presented a paper of an allied nature, entitled "Influence of Sugar Upon Cements," which gave evidence of the beneficial effect of small percent-

gave evidence of the beneficial effect of small percentages of sugar in many cases, but the very destructive effect of large amounts.

Mr. J. E. Denton then wished to know if sugar had been used to any appreciable extent in practice; and also stated that as great care seemed (from Mr. Parsons' paper) necessary in the mixing of the sugar with the cement in order that any benefit might be derived, it would seem best to try to keep sugar out as far as possible.

ble.

Mr. John Coffin's paper on "Steel Car-Axles" was next presented and attracted much attention. It was discussed by William O. Webber, William Hewitt, J. E. Denton, E. C. Felton, T. R. Almond, F. W. Taylor. H. S. Haskins, and H. R. Towne.

The next paper, entitled "Results from Steel Tested Shortly After Rolling," by Mr. Edgar C. Felton, pointed to the conclusion that steel after rolling went through a certain process (which he termed "seasoning" for lack of a better word) which caused it to become stronger, and

certain process (which he termed "seasoning" for lack of a better word) which caused it to become stronger, and hence it would not be just to the maker to test it immediately after rolling. The paper was discussed by Messrs. Jacob Reese and William Hewitt.

The next paper, "The Use of Kerosene Oil in Steam-Boilers," by Mr. Lewis F. Lyne, brought discussion from Messrs. Ridgeway, F. A. Halsey, Engel, and Denton, all of whom differed, except that it would always be well to have the scale in the boiler analyzed, as it might thereby become possible to tell what might remove it.

of whom differed, except that it would always be well to have the scale in the boiler analyzed, as it might thereby become possible to tell what might remove it.

Mr. J. M. Dodge's paper, entitled "Method of Stocking and Reloading Coal," brought out some questions from Messrs. M. T. Davidson, and W. F. Mattes.

The next paper, by Mr. O. C. Woolson, on "Railroad Bed for Bridge Structures," in which a built-up elastic tie is used, seemed to meet with the general approval of the society and was but little discussed. Professor Denton said that he had noticed on the elevated roads in New York that used this tie a perceptible improvement in the smoothness of motion in traveling over the road.

Mr. C. E. Emery's paper, "An Interesting Indicator Diagram," was read by and brought a few remarks from Professor F. R. Hutton, but excited no discussion.

The last paper, "Improvement in Shaft Governors." by M. F. H. Ball, brought out remarks bearing upon various forms of governors, and reaching over the space of forty or fifty years. The following persons joined in: Messrs. J. Burkitt Webb, J. T. Hawkins, George H. Babcock, J. E. Denton, Walter C. Kerr, H. Bilgram, L. F. Lyne, M. T. Davidson, J. B. Ladd, and W. R. Warner.

There were ten topical questions on the programme of

There were ten topical questions on the programme of the meeting, though but few of them brought out any remarks. The question, "What is the Best Material for Lining Brake-Straps on Elevators, Cranes, etc.?" was answered by Mr. E. D. Leavitt, Jr., as follows: That he had gotten the best results from soft woods, such as popular alleged upon the drum (not as a lining of the brake. lar, placed upon the drum (not as a lining of the brake-straps, the straps bearing upon the wood being of metal. At the Calumet and Hecla Mines these lasted about a month. Water ran constantly on the wooden casing of

Resolutions of thanks for the unbounded hospitality and attention shown the society were adopted with cheers.

An elegant reception was tendered the society by the citizens of Philadelphia at their Academy of Fine Arts. Paintings, a fine orchestra, a bountiful supper, and beau-

Paintings, a fine orchestra, a bountiful supper, and beautiful flowers adding to the enjoyment of the occasion.

Thursday was devoted to an excursion to Bethlehem, Pa., as the guests of the Bethlehem Iron Co. A special train was provided for the society. While on the way cigars, sandwiches, bananas, and grapes were freely passed around and partaken of. All which, together with the expense of the excursion trip, and also a most excellent lunch at the office of the works, was the courtesy of the Bethlehem Iron Co.

Carriages were found awaiting the party at the depot,

Carriages were found awaiting the party at the depot, and the majority got into them and drove up to Lehigh University. The Zinc Works were next visited, then the University. The Zinc Works were next visited, then the Bethlehem Iron Co. The train came down into these works at 4:30 P. M. where all took the train and returned to Philadelphia.

Complimentary tickets having been previously supplied to the members of the society they were entertained on Thursday flight by Booth and Barrett in "Julius Cæsar" and by the opera "Erminie."

Thus closed the eighth annual meeting of the American Society of Mechanical Engineers, the largest and most

successful ever held by that body.

The following members were present:

Life Members.—Charles Wallace Hunt, New York;

Julio Frederico Sorzano, New York.

Members.—Otto Albrecht, Philadelphia, Pa.; Robert

Members.—Otto Albrecht, Philadelphia, Pa.; Robert Allison, Port Carbon, Pa.; Thomas R. Almond, Brooklyn, N. Y.; Daniel Ashworth, Pittsburg, Pa.; George H. Babcock, New York; Stephen W. Baldwin, New York; Frank H. Ball, Erie, Pa. J. Sellers Bancroft, Philadelphia, Pa.; George A. Barnard, Hartford, Conn.; William H. Barr, Brooklyn, N. Y.; Arthur Beardsley, Swarthmore, Delaware County, Pa.; Alfred Betts, Wilmington,

Del; William Betts, Wilmington, Del.; Hugo Bilgram, Philadelphia, Pa.; George M. Bond, Hartford, Conn.; James C. Brooks, Cambridge, Mass.; H. W. Buckner, New York; J. M. Boide, New York; James Butterworth, Philadelphia, Pa.; R. C. Carpenter, Lansing, Mich.; Robert Cartwright, Rochester, N. Y.; Joseph Cavanagh, Philadelphia, Pa.; C. C. Collins, Newark, N. J.; George N. Comiy, Edgemoor, Del.; John H. Cooper, Philadelphia, Pa.; C. C. Collins, Newark, N. J.; George N. Comiy, Edgemoor, Del.; John H. Cooper, Philadelphia, Pa.; Thos. S. Crane, Newark, N. J.; George N. Comiy, Edgemoor, Del.; John H. Cooper, Philadelphia, Pa.; Thos. S. Crane, Newark, N. J.; George N. Collingworth, New York; E. E. C. Davis, Pottsville, Pa.; Isaae H. Davis, Dorchester, Mass., Francis W. Dean, Cambridge, Philadelphia, Pa.; Particle, Pa.; Isaae H. Davis, Dorchester, Mass., Francis W. Dean, Cambridge, Philadelphia, Pa.; W. P. Durgee, Racine, Wis.; William H. Doane, Cincinnati, O.; James M. Dodge, Philadelphia, Pa.; W. P. Durgee, Racine, Wis.; William H. Doane, Cincinnati, O.; James M. Dodge, Philadelphia, Pa.; W. P. Durgee, Racine, Wis.; William H. Doane, Cincinnati, O.; James M. Dodge, Philadelphia, Pa.; W. P. Durgee, Racine, Wis.; William H. Doane, Cincinnati, O.; James M. Dodge, Philadelphia, Pa.; W. P. Could, Norwich, Conn.; H. C. Francis, New York: Frederick Grinnell, Frovidence, R. I.; Charles A. Hague, New York City; F. A. Halsey, New York City; Alex. Hamilton, Jr., Johnstown, Pa.; S. Ashton Hand, Chester County, Pa.; John T. Hawkins, Taunton, Mass.; V. Backee, Path. M. George, Philadelphia, Pa.; W. P. Guld, Middletown, Conn.; J. F. Holloway, Cleveland, O.; Frederick R. Hutton, New York City; Charles H. Meyard, Philadelphia, Pa.; Frafiladelphia, Pa.; William F. Markee, Path. Meyard, Philadelphia, Pa.; Charles E. Hyde, Bath, Me.; John Jenkins, Milton, Pa.; Walter, Lewis, Philadelphia, Pa.; Charles H. Horng, Washington, Del.; William H. Milliam, Pa.; Charles E. Lipe, Syracuse, N. Y.; Charles H. Loring, Washington, Del.; William C. Macki

SOME SKETCHES OF PLUMBING IN THE RESIDENCE OF WILLIAM F. WELD, ESQ., BROOKLINE, MASS.

No. 1V.

(Continued from page 10.)

FIGURE 12 is a view within the plunge-bath room. The bath proper is set in the floor and can be entered by two steps at one end. It is made of $2\frac{1}{2}$ -inch oiled soapstone slabs, tongued and grooved and held together by brass bands. It projects down into the ceiling of an unimportant room, and all its pipes are exposed and accessible from below. A standing overflow is used and it is placed in the corner of the tub, as may be seen. The finish of the tub, back and end slabs, and casing for faucets are Italian marble. The walls are white-glazed tiles and the floor buff tiles. The shower-bath is operated from the end. A window high above the floor is placed at the foot of the

buck-stays are used at the centre and iron rods at the top and bottom are carried across to hold the long sides. The laundry tank is 6x4x2 feet and similarly made; they are both lined with 18-ounce copper.

An artesian well 217 feet deep supplies water for flushing purposes. The water from this well is forced to the house by a Deane "deep-well" steam-pump at well. The drinking supply comes from a dug well, which is 45 feet deep; a double Coleman pump is used for this purpose and is situated in the cellar.

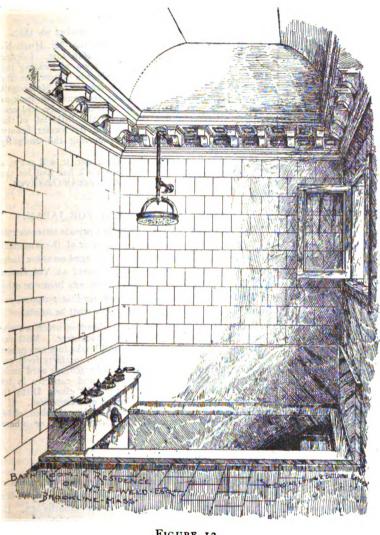
The architect of the building was Mr. Edmund M. Wheelright; the master plumbers were Messrs. Henry Hussey & Co., whose foreman in charge of this work was Mr. W. J. Kelley; the drainage of the house was planned by E. W. Bowditch, C. E., and the sub-soil drainage by Messrs. Aspinwall & Lincoln, all of Boston.

natural gas and sanitary reforms, seems to be fast approaching that condition.

[This is a step in the right direction. Pittsburg is fortunate in having a gentleman in her Common Council intelligent enough in sanitary matters to recognize the fact that a plumbing law is of little avail to protect a community unless provision is made for its enforcement. His influence to secure such action as has here been taken is, therefore, a cause for congratulation.—ED.]

A DOMESTIC BOILER EXPLOSION IN MILWAUKEE.

THE first of the usual series that we are to have this season of water-back and boiler explosions, due to the carelessness in starting a fire when the connections are frozen and the circulations interrupted, occurred last week in Milwaukee. In this case the boiler, which was five feet by twenty-two inches in diameter and of a capacity of 100 gallons, was thrown through four floors of the Kirby House in that city, and out on the roof, injuring several servants and killing one. We suppose these accidents will continue to occur just so long as careless and ignorant people start fires that will generate steam without the fact being ascertained that the pipes and water-backs are free from obstructions.





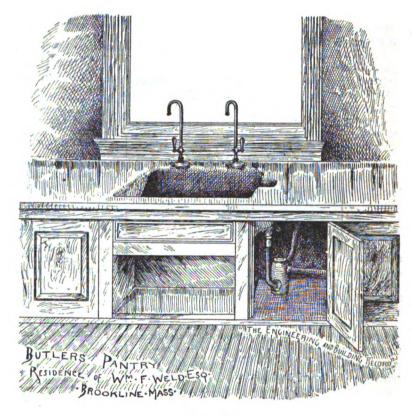


FIGURE 13.

Figure 13 shows the butler's pantry sink. It is made of wood lined with block tin one-eighth of an inch thick, as is also the whole top of the drain-board. It is 10 inches deep by 16 inches wide by 27 inches long and is "burned" together at the corners so as to show no seams, and the standing overflow is arranged and protected within a bay at the right-hand end. The trap and waste-pipe are thus arranged within the closet to the right, as is plainly seen in the illustration through the open door, and do not show beneath the sink; the space thus formed being entirely open and unobstructed. The walls are marble wainscoting; the floor is oak and the wood-work cherry.

The other sinks of the house are all oiled soapstone, except the servants' dining-hall sink, which is ceramic ware. The kitchen sink is 41 inches inside in length by 21 inches wide by 7 inches deep, with 18-inch drain-board of soapstone. The sink in the milk-room is 24x36 inches, with 15-inch drain-board. The cellar sink is 24x30 inches, with 12-inch drain-board, and the ceramic sink in the servants' hall is 26x18 inches.

There are seven water-closets in the building.

The main water-tank is 12 feet long by 4 feet wide by 4 feet high, made of tongued and grooved pine, two inches thick, held together by iron rods at the ends; wooden

A PLUMBING INSPECTOR FOR PITTSBURG.

(From an Occasional Correspondent.

AT a recent meeting of the Pittsburg City Council the question of sanitary methods and reform came up as the business of utmost importance, and, after long and interesting argument in favor of a proper and systematic form of inspection of all sanitary work and plumbing in the buildings of the city, an amendment was offered, passed, and inserted in the code of the city laws, providing for the appointment of a competent inspector at a salary of \$1,500 per year, whose duty it shall be to report violations of the sanitary laws.

Pittsburg is keenly alive to the necessities of reform in this respect, and the remarks of a prominent railway official and a member of her City Council, Mr. S. D. Warmcastle, that "there are more lives lost by imperfect plumbing than by buildings falling down," is quite to the point. Too great praise and credit cannot be given to this gentleman for his advanced and pronounced ideas and his vigorous action in placing Pittsburg on record as worthy of example by many of her larger but less active cities. We need more men like Mr. Warmcastle in this respect, and if Pittsburg's wise Council will supplement the good work by the appointment of a thoroughly competent plumber as inspector, with an advisory board with full powers of arrest and prosecution of violators of her sanitary laws, they will indeed have achieved a victory to be proud of. From the dirttest to the cleanest city in the country seems a great transition, but Pittsburg, with her

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any ofter of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

A SPRAY OR SHOWER ATTACHMENT FOR BATH-TUBS.

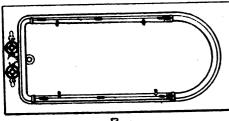
THE subject of the novelty here illustrated is an attachment for bath-tubs, designed to dispense with all exposed cocks or bibbs with their projecting spouts, and to secure a noiseless flushing rim supply in filling the tub, and after the bath has been emptied to act as a flushing device to wash from the tub all the residuum of a bath, by turning on the water for a few moments.

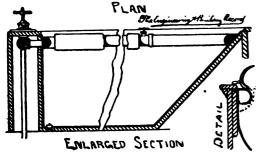
It is designed to remove the chill of porcelain and porcelain-lined iron tubs, making them of the same temperature as the water above the water-level by turning on the hot-water spray. It is claimed that the crazing of glazed



tubs is rendered less liable to occur with hot water thus admitted.

The flushing-rim from the foot to the head of tub is made of a finely perforated pipe, so arranged with a deflecting-hood or shield that when turned down it directs the water to the sides, but when a needle spray or shower is required the shield or hood is turned up, whence the





fine sprays are thrown to their opposite sides, reaching from the centre of tub to within six inches of the top, so that the person at full length is completely showered without the splattering of water over walls and floors, as from the old-fashioned overhead showers.

It is the invention of and patented by Mr. Frank A. Wells, of New York, and manufactured by the Standard Manufacturing Company, of Pittsburg.

AN ECONOMICAL (?) METHOD OF HEATING AND VENTILATING AN OFFICE AND WAREHOUSE BUILDING.

THE following extracts are from a paper presented by Henry I. Snell at the sixteenth meeting of the American Society of Mechanical Engineers, just held at Philadelphia, and termed, "An Economical Method of Heating and Ventilating an Office and Warehouse Building.

The title is very comprehensive, no doubt, but what relation it has to the matter that follows it we are at a loss

If it was entitled "A Method to Warm a Small Storage Building "we would refrain from a comment, but where the question of ventilation comes in or the measure of economy is shown is not apparent.

We have no doubt it is more economical in the matter of fuel than the attempt to warm the same space with grate-fires, but beyond this it proves nothing at all. If the single item of fuel was given and the amount of air circulated the reader might make a digest for himself and determine the economy versus direct radiation or any other style of heating.

Of course, the author cannot mean that the circulation of air from one floor to another makes ventilation. It may be nearly as good as taking fresh air from out of doors in his particular case, but he should remember that every office-room has not a building next to it or above it that it can draw on for its air-supply.

The paper fails to give the information necessary to justify the title adopted. The author says:

"I will describe briefly a method I have had in my store "I will describe briefly a method I have had in my store at Philadelphia, Pa., for the past two winters, which has been very satisfactory. It has been very economical, and dependence could be placed upon its efficiency at all times, no matter what the condition of the weather might be.

An exhaust fan driven direct by a small unright and its property of the state of the same in the same

An exhaust fan driven direct by a small upright engine is connected with a "patent air-heater" placed in the basement at the front of the store by an 18-inch galvan-

An upright boiler in the basement furnishes steam to An upright bolter in the baselinent runtiles steam from the engine is delivered through the exhaust steam from the engine is delivered through the exhaust-pipe into the base of the air-heater on one side, and the drip and condensed steam

is conveyed away through a pipe at the other.

The exhaust steam of the engine furnishes all the heat The exhaust steam of the engine furnishes all the heat usually used, but as a precaution, and for use early in the morning, in extremely cold weather, or for use in very moderate weather, in the middle of the day, when it is unnecessary to run the engine, a small live-steam pipe is connected with the base of the heater. The fan runs at a very low speed, and is perfectly noiseless. In my case, no conducting pipes for the distribution of the air are

necessary, and the variations of temperature in different parts of the store are not observable with the ordinary commercial thermometer. By examining the sketch it commercial thermometer. By examining the sketch it will be seen the store itself becomes one large conductingtube—and the air is used over and over again, enough fresh air coming in through openings around the windows and through doors constantly being open. An opening near the bottom of the heater has been provided, and can be used for supplying fresh air when greater ventilation and less heat are required.

The following data are submitted:

Length of store, 95 feet; width of store, 24 feet; height of basement, 8 feet 6 inches in the clear; height of first or main floor, 13 feet in the clear; height of second floor, 11 feet 6 inches in the clear.*

The side walls are brick, inside walls plastered, and have no openings.

The front is almost wholly of glass, and the large windows are hinged, and open or close like a door. They are not very tight. About three fourths of the wall-surface of the back end is composed of glass, the rest of brick.

The building is five stories and basement, and I only occupy and heat the first and second stories and basement, but I think I could easily heat the whole with my apparatus at a very little increase of cost in fuel

apparatus at a very little increase of cost in fuel.

apparatus at a very little increase of cost in fuel.

The engine that drives the fan is 3 inches in diameter, and has 3 inches stroke. The wheel in the fan is 36 inches diameter, and 13½ inches wide at the outlet of wheel; the area of discharge of blower 1.76 square feet and the inlet is same size. The heater is about 3 feet wide, 6 feet 6 inches high and 20 feet deep, and filled with 588 feet of 1-inch steam-pipe. I am so well satisfied with the results I get from this apparatus that I have not made any close and accurate experiments of what I not made any close and accurate experiments of what I can do with it. I know from the cost of my fuel that the expense of heating all I occupy is about the same as I formerly paid when I only heated the offices which were partitioned from floor to ceiling and heated with open grate. I might return the condensed water from the heater to the boiler and make a great saving. This is

not done at present.

Possibly before the meeting of the society we may have some cold weather, requiring the use of the apparatus, and if this paper produces any discussion by the members, some careful experiments upon its performances may be had before them; but at present I can only give the results of one imperfect and incomplete observation, made during December, when the outside temperature was 45

Temperature of the air on its return and just before entering the heater, 59°.

Temperature of air issuing from the mouth of the blower

Average of temperature of air issuing from the mouth of the blower after passing through the heater, 112°.

Average of temperature of air in the room of the main store, on first floor, 75°.

Pressure of steam in the boiler by gauge, 40 pounds. Revolutions of blower, 113 per minute.

I have made arrangements by which I can measure the evaporation of boiler, condensation by the heater, steam pressure at cylinder, and temperatures at various places pressure at cylinder, and temperatures at various places in the rooms, but to put them in operation I require another element, which I can only obtain later in the season—

viz., cold weather.

I have co apparatus which will give more heat-units than contained in the steam, but I do think I have one which will utilize those obtained to the greatest advantage, and one that will work when I want it to, and as I want it to, independent of atmospheric condition even when the winds blow where they list."

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

MANUFACTURERS OF SEWER-PIPE MACHINERY.

In response to questions from Mr. Burns, of Victoria, B. C., on page 745, issue of November 26, a correspondent sends in the following addresses: Turner, Vaughan & Taylor, Cayuga Falls, O.; J. W. Penfield & Son, Willoughby, O.; O. Barber, Akron, O.; Stevenson & Co., Wellsville, O.

THE BOUND BROOK, N. J., WATER-WORKS. LAMBERTVILLE, N. J., November 24, 1887.

SIR: I notice in your last issue you advise addressing the Commissioners regarding the water-works at Bound Brook. The Commissioners have nothing to do with the matter, save the granting of permission to build, as the matter will be carried along by the Bound Brook Water Company, a corporation which will be organized in a few days, and in which I will hold the controlling interest. We do not propose to contract for any part of the work, but the same will be in charge of a competent engineer, and the work first-class in every particular. I have

* This floor I only heat occasionally, as it is used principally for the storage of machinery. When necessary to heat it I open the damper shown directly over the mouth of the blower, and sufficient heated air will be driven through the opening to heat it comfortably in a

received a batch of letters in response to your notice, the same having been turned over to me by the Commissioners.

Will be glad to give you any information regarding the progress of the work from time to time, should you so desire.

The capital of the company is \$40,000. The company will begin work with \$15,000.

The incorporators are: Sylvanus Ayres, Jr., Torbert Coryell, Lambertville, N. J.; William H. Ayres, Benjamin K. Burke, James M. Thompson, Ransom Lamb, O. B. Reynolds, Bound Brook, N. J.

The water will be taken from Middle Brook. The main pipe will be ten-inch cast iron, and will be 21/2 miles long. The fall will be about 100 feet. The surveys have been made. The dam will be built this winter, and we hope to have the whole thing completed by the 1st of June, 1888.

S. AYRES, JR. Very truly yours,

NEW YORK MUNICIPAL BUILDINGS AND THE CITY HALL.

NEW YORK, November 30, 1887.

SIR: I was much pleased with reading Mr. Hugh N. Camp's remarks in your issue of the 26th inst. I desire to supplement them with the suggestion of locating the proposed buildings on Sou h Washington Square, the city to purchase the block from Thompson to McDougall Streets, a frontage of about 450 feet running back to Third Street. Property in this location can be had reasonably. Carrying out this idea, the little left of the City Hall Park will be saved and its former beauty restored by perhaps, in time, removing the unsightly Court-House.

If the above suggestion is carried out it will prove a monument of the best Mayor New York has had for the past fifty years.

A VETERAN OBSERVER.

DREDGING MACHINERY FOR JAPAN.

THE following is an extract from a private letter written to a gentleman in this city by a member of the American Society of Civil Engineers who is engaged on some large contracts for the Japanese Government at Yokohama. We shall be pleased to forward to him any books or other information that may be sent here for that purpose, and trust some of our readers can supply what he needs.

"There seems to be some work ahead on which we may be able to introduce American machinery. Will you kindly send me such pamphlets and books (not too expensive) relating to deep-sea dredging (up to thirty feet) and river dredging, giving description of machines used under different conditions, cost of plant, and capacity in ten hours in sand, mud. gravel, and light clay. Ditto for steam-excavators. Also number of men employed. If I am not mistaken, there are certain books published, either by the dredging companies or manufacturers, or others, giving just this information."

LONDON CORRESPONDENCE.

CAPTAIN SHAW, the Chief of the Metropolitan Fire Brigade, has made his report on the Exeter Theatre fire, whereby so many lives were lost a few months ago. He reflects very strongly upon the custom which frequently exists, and which existed in the case of the Exeter Theatre, of having shops in the lower portion of the building, where exit doors might most profitably be placed. With regard to the verdict of the Coroner's jury, reflecting upon the architect, Captain Shaw has declined to see the justice of blaming the architect, and has pointed out that the licensing authorities are those distinctly to blame, in that they had licensed the theatre with its existing defects. It is a pity that the custom of putting the blame upon the right shoulders, notwithstanding the influence of the parties, is not more frequently followed out by inspectors and people in authority.

Another instance in which it has been rightly allocated is in connection with the trial for manslaughter of the driver and fireman of the train that was instrumental in the Hexthorpe disaster. The jury acquitted the men on the ground that the railway company was to blame; that the suspension of the "block" system was unjustifiable, and that the signaling was confused and contradictory. The scapegoat principle has not been successful in this case either. No one will feel inclined to doubt that either in the case of the Exeter Theatre or in that of the railway calamity, the architect in the one case and the driver and fireman in the other, distinctly contributed in a very large way, it may be, to the results. While recognizing this fact, however, it is equally palpable that the superiors having the directing power, and failing to apply their power



rightly, were the main contributors to disasters in both

FOR external architectural effects, the late Mr. Street, in the case of Law Courts, is generally admitted to have scored a success. Judging from the continued complaints received of the heating, ventilation, and lighting of the interior, justices' rooms, etc., the success cannot be said to have been more than skin deep. The latest I hear is that in connection with the scheme of drainage, the drainage finds its way into the water-tank from which the boilers, etc., are supplied. This was probably not intentional, but it is unfortunately a fact.

THE work in connection with the long-spoken-of Manchester Ship Canal is at last started.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING was held at the society's rooms. Wednesday evening, December 8, President William E. Worthen in the chair. A resolution was passed fixing the dues for the proposed new grades for students and associate members, which it was deemed necessary to do at this meeting in order to comply with the constitution. The resolution specifies that in the event of the adoption of the grades of associate member and student the dues for associate members shall be the same as now fixed for associate, and the dues for the student grade shall be ten dollars for resident and six dollars for non-resident students.

The secretary then read the closing discussion on William Metcalf's paper on "Steel, Some of its Properties; its Use in Structures and in Heavy Guns," which was read by the author March 2, 1887. This was followed by a paper giving some experiments on the "Protection of Piles from Limnoria and Teredo in San Francisco Bay," by Marsden Manson, M. Am. Soc. C. E.

The following gentlemen were elected as members: Tucker Carrington Eggleston, Resident Engineer in charge of maintenance of way Richmond and Allegheny R.R., Richmond, Va.; Charles Edward Newham, First Assistant and Locating Engineer Vincennes and New Albany R.R., Vincennes, Ind.; Henry Bowman Seaman, Principal Assistant Engineer with Wilson Bros. & Co., Philadelphia, Pa. As juniors: William Pierson Field. Assistant Supervisor Division A. New York Division Pennsylvania R.R., Newark, N. J.; Robert Van Arsdale Norris, Assistant Engineer Susquehanna Coal Co., Wilkesbarre, Pa.

STEEL FOR STRUCTURES AND HEAVY GUNS. BY WILLIAM METCALF, M. AM. SOC. C. E.*

In closing the discussion on this paper, the author replies as follows to those who have taken part in it:

replies as follows to those who have taken part in it:

"In the effect of slow cooling producing large crystals and weak structure, Mr. Marshall ignores the fact that slow reheating to the right temperature will insure the formation of uniformly minute crystals and great strength, and that, having secured this condition, cooling from the interior, whether rapid or not, will secure initial tension in the direction desired. Here is the true motive power with which to handle large masses of steel, and not steam."

In regard to measuring expansion, he states that "if a steel rod ½ an inch in diameter be heated to a heat that is uncomfortable to the hand, say 120 to 150 degrees. it will

uncomfortable to the hand, say 120 to 150 degrees, it will enlarge its diameter. 004 of an inch. Apply this to a gun ring 2½ inches thick and you would have a change. 02 of an inch in thickness. A summer sun will do this and more for any yn thickness. A summer sun will do this and more for any gun ring; then what becomes of definite shrinkage and elastic limits?

"Steel cannot be welded safely by any known process, unless it be the new electrical method, confirming Mr. Howe's experiment.
"I thought always of continuity."

unless it be the new electrical method, confirming Mr. Howe's experiment.

"I thought always of casting the gun hollow by the Rodman method, but the difficulties of managing the core would be so great that I believe Mr. S. T. Wellman's plan would be wiser—i. e., to cast the block solid, bore out the centre, and then proceed with the treatment. This is no modification of the principle, but it simplifies greatly the whole operation, and removes from my mind the only doubt I ever had about the feasibility of the plan. I believe a large mass of steel can be treated by heat more surely, more cheaply and better than by any known mode of forging; and that by cooling on the Rodman principle a gun can be made to have, with absolute certainty, the tension in exactly the direction, and to the degree that is most desirable."

In reply to Mr. Becker he says: "Use dead soft steel annealed carefully; never without annealing Do not mind the blow-holes, they indicate mild steel; but be very careful to avoid sharp angles and complications of unnecessary ribs. Always study simplicity of form, and fillet thoroughly every corner."

In reply to Mr. Wilson he states: "I do not know of any way to test an eye-bar for over-annealing without

*Read before the American Society of Civil Engineers, March 2,

* Read before the American Society of Civil Engineers, March 2, 1887.

injury to the bar, unless it would be by discovering a greatly reduced elastic limit. Mr. Dorsey first, and myself later, have done a good

work in drawing the Government officers out of their shells. They have proven themselves to be hard-working, painstaking, able gentlemen, genial, courteous, and well-fitted to maintain their position. They have shown us that they have designed and made the best moderate sized steel have designed and made the best moderate sized steel guns in the world, and they have expressed their satisfaction with American steel-makers. From this time out I shall shout: 'Give our Ordnance Corps all the money they need:' and I shall stick quietly to my opinion that the best way to make a big gun is to cast it and treat it by heat slove."

He then refers to Mr. Coffin's discussion of his paper, and states: "Next I offer the theory that hardening is caused by tension; that tempering and annealing are reductions of the tension by heat. If hardening is a mere change of condition of carbon, why should a piece crack when hardened? Let anv person take a round bar of steel of any carbon above. 60 and overheat it just a little, and with perfect unitormity of temperature, and quench it, and it will split up the middle. A bar of any section will do the same, but the round section splits the easiest. Heat relieves the tension and softens the steel. A given temperature relieves a certain amount of tension and no more; therefore, as Mr. Coffin says truly, if the first annealing does not give you softness enough, no He then refers to Mr. Coffin's discussion of his paper. and no more; therefore, as Mr. Comn says truly, it the first annealing does not give you softness enough, no number of repeated heatings of the same temperature will give any greater softness. It is a happy fact. Given, say, a car-spring: it has a certain elacticity, temper, given to it by quenching. It may be frozen to 40 degrees be-low zero and heated to 120 or 130 degrees in the sun, thousands upon thousands of times, yet it retains its ten-sion and carries its load for many years. Consider, too,

it accord with either the 'cement and hardening carbon' it accord with either the 'cement and hardening carbon' theory or the tension theory. Therefore, as I said before, I suspect that the change is effected by the absorption of some gas. To anneal properly, then, heat to the lowest heat that will give the degree of softness required, and allow a short time for the particles to arrange themselves; then cool as slowly as possible, the slower the cooling the greater the softness that is retained. Heat produces the softness slow cooling ratios it.

of these, slow cooling retains it.

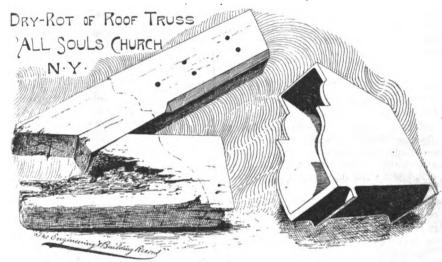
"I have stated that all steel will harden if it contains any carbon at all, and also that even cast-iron will harden and anneal. This statement includes the so-called 'selfhardening' steel. It is easy to anneal the hardest self-hardening steel so that it may be drilled, filed, and cut like any other steel, and then to harden it. The quench-

hardening steel so that it may be drilled, filed, and cut like any other steel, and then to harden it. The quenching medium for 'self-hardening' steel is air. Water or oil will crack it almost every time."

Mr. Theodore Cooper had previously stated that the valuable and instructive 'paper read is one of especial interest. All engineers realize that steel is to be the structural material of the future, and, with a material covering such a wide range of properties, it is absolutely necessary that they should know its characteristics and capabilities. Papers from men who are daily watching and studying its characteristics, noting defective results and searching for the reasons thereof, not proving their conditions by simple laboratory tests, but by the successful attempt of a manufacturing establishment of no mean character, demand careful study and consideration.

DRY ROT IN THE ROOF OF ALL SOULS' CHURCH, NEW YORK.*

THE illustrated description in our issue of October 15 of the case of dry rot in the floors of Holbrook Hall, a



the permanency and exactness of the springs of watches and clocks.

"Experience teaches that, in tool steel at least, we know "Experience teaches that, in tool steel at least, we know of no temperature above that of the atmosphere at the time from which if steel be suddenly quenched it will not show that it is hardened to an amount due to the temperature applied. We cannot recognize any fixed temperature where hardening begins. On the contrary, it is a function of the temperature and has some value for every degree of temperature; also, there is a regular increase of softness for every degree of heat that is addded, until steel becomes liquid

A fracture of steel always indicates the highest temperature to which the steel was last subjected, no matter how it may have been cooled, provided it had not been ham-mered or rolled or otherwise worked mecha..ically.

"Fractures are not alike for the various carbons, but they are so similar that they will soon convince any one that they all obey the same law. It is not to be supposed when we say steel always records its highest temperature, no matter how it may be cooled, that a bar quenched, and another cooled in air, and a third cooled in a bed of warm ashes, from the same temperature, will have the same fractures; they will be different. But a thousand bars, or a million bars, of the same composition, heated to the same degree and cooled in the same way, will have identical fractures." The writer then explains the refining theory by circles of differing diameters, and concludes by stating that "possibly the most important of all is that Fractures are not alike for the various carbons, but they stating that "possibly the most important of all is that the difference in specific gravity is in low steel much less than in high steel; as, for instance, for 40-carbon the difference is only one-fifth of the difference shown in 120 carbon steel. This is the reason that mild steel is not easily ruptured by a high heat; it is also the reason that a mild steel may be rehardened many more times than a high steel without breaking. It shows, too, if the tension theory be correct, that it is difficult to set up a dangerous strain in mild steel, so that engineers need have little fear about using it.

I have known 'dead soft' steel to be over-annealed "I have known 'dead soft' steel to be over-annealed, so that no amount of subsequent annealing and coaxing would make it anything but rotten and worthless. I believe this comes more from soaking heat than quick overheating. I thought at one time that it was caused by a permanent change in the condition of the carbon in the steel—that it became like an excedingly fine cast-iron—but this will not hold, because cast-iron will harden and temper if it does not contain too much silicon. Neither does large apartment-house in this city, has drawn the following from O. P. Hatfield, and the accompanying illustration is from a photograph kindly furnished by him.

Mr. Hatfield says:

"In reference to the decay of the timbers of the roof-trusses of the church corner Fourth Avenue and Twentieth Street, in this city, I send you the accompanying photograph, taken at the time of the restoration, from the ends of the timbers of one of the trusses, showing the decay thereof and also giving a view of the cast-iron shoe which enclosed the end of the truss. The decay is supposed to have been caused by the deprivation of air, consequent upon being confined within the circlett iron when sequent upon being confined within the air-tight iron shoe, preventing the escape of the moisture which generally is discharged at the end of the timbers. The deterioration in this case was rendered the more dangerous from being concealed from view, and was only discovered by the evidences of settlement that finally appeared.

The truss here shown was one of two that supported the central dome of the church. The trusses were all re-

moved without disturbing the roof and new ones substi-tuted. I presume the lesson to be learned from this case is to never deprive the ends of timbers of free access to the air."

THE INTERNATIONAL EXHIBITION AT BRUSSELS.

THIS universal exposition of the products and appliances of science, art, and industry will be held at Brussels during the summer of 1888.

Among the departments in which prizes will be awarded, the following will be of special interest to our readers: Instruments of Precision and Measurement; Heating and Ventilating Apparatus; Designs and Appliances Relating to Civil Engineering and Public Works, and to Architecture and Building Materials; Drawings, Paintings, and Sculptures, Monumental, Architectural, Decorative, and Industrial: Mechanical Tools and Processes: Steam-Engines and other prime motors; Railways and Rolling Stock.

*The church of the late Dr. Bellows (Unitarian).

Applications for space must be filed before January 15, 1888, and entries of proposed exhibits made before April 15, 1888.

Armstrong, Knauer & Co., of 822 Broadway, New York City, are the agents in the United States for the exposition, and should be addressed by those desiring further information.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York	Manhattan	Metropolitan	Mutual	Municipal	Krickerbocker	Equitable
	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light
	Company.	Company.	Company.	Company	Company.	Company.	Company.
December 3	24.23	19.75	20 78	29.83	27.77	24.20	31.75

THE heat evolved by electric-lighting is, according to Iron of October 14, to be turned to profitable account by a Berlin Electric Company, which has announced that in future it will be prepared to furnish electricity for heating purposes.

WE recently quoted from an exchange that the Duke de Feltre was experimenting, near Havre, with an apparatus to use wind for driving dynamos. We learn from L. Vigreux, in *Le Genie Civil* of October 8, that this inconstant force has been successfully used by the Duke de Feltre, accumulating electric energy, then transporting it with the aid of accumulators to any point to be used for power or lighting purposes.

THE Chronique Industrielle of October 9 contains a description of the electric apparatus of M. Somzee, which has as its object the prevention of collisions at sea. It is based on the well-known theory of using the water, instead of wire, for the transmission of the electric current, and working automatically, it announces the presence of one vessel to another, within a certain electric zone, provided both vessels are equipped with the Somzee apparatus.

THE Revue Industrielle of November 10 gives an account of a recent experiment in signalling at night by electric lights in a balloon. The system is that of M. Bruce, and the experiments were conducted near the city of Anvers. The bulloon was of a diameter of 4m-20. The connecting signal cable contained two copper wires, connected with a battery of 25 accumulators, producing a current of 12 volts and 72 amperes, capable of furnishing six 20-candle-power lamps for 78 hours. The signalling is done from the ground-no one being in the balloon-by means of a Morse instrument. When the circuit is closed the current is sent through the lamps. By short or long intervals of opening and closing the circuit it was found that the Morse telegraphic cipher could be easily reproduced. The first trials were made with the lamps distributed in a circle in the interior of the balloon. subsequently the six were grouped together and hung under the balloon. In both cases the signals were understood at a distance of 3,000m. The balloon only rose about 100m.

La Lumière Électrique of November 12 states that photometric comparisons of incandescent lamps were recently made at Antwerp to establish the following four points: First, the mean horizontal intensity of the light; second, the relative intensity under different angles; third, the mean spherical intensity: fourth, the variations in the luminous intensity with varying electromotive force and strength of current. The means for determining these qualities necessitated elaborate apparatus. The experiments demonstrated the mean horizontal intensity to be .919 for a given lamp, while the mean intensity at 45° or transversely was .915. The relative intensities of angular rays were ascertained and graphically illustrated by curves. The mean spherical intensity was found to be .8 that of the horizontal intensity. The variations of luminosity due to varying electromotive force and current strength were different for each special kind of lamp, but a definite formula was deduced and confirmed the experimental results mathematically.

THE Red Cross Society has offered a prize of 6,000 marks (\$1,400) for the best design for a portable hospital.

THE NICARAGUA CANAL EXPEDITION.

This expedition, which sailed gallantly out of New York harbor on November 30, marks an important step in an enterprise most important to this country and to the civilized world, and it derived additional consequence from the admission just made by De Lesseps that, for the present at least, he had abandoned the idea of a sea-level canal at Panama.

This deprives the Panama route of what is generally regarded as its sole advantage and will doubtless give an impetus to the Nicaragua scheme.

The citizens of this country certainly hold at Nicaragua and Tehuantepec two of the most important gates of interoceanic communication on this hemisphere, and it will be interesting to see which gate shall be opened first.

It will be remembered that four years ago the Tehuantepec route was carefully surveyed and a very satisfactory line located; sufficient grading was also done to comply with the terms of the concession, and while the untimely death of its great projector was a serious blow to the enterprise, the concession is valuable and the route advantageous, so that the project is not likely to be easily abandoned.

PROGRESS IN CAR-HEATING FROM LOCOMOTIVE.

FIGHTY passenger coaches on twenty-two local trains of the New York Central and Hudson River Railroad have been furnished with appliances by which they can be heated directly from the locomotive. These trains are between Buffalo, Lockport and Niagara Falls, and between New York and Croton, and also on the Buffalo Belt line.

Last Wednesday a special "vestibule" train was run from New York to Albany and back to exhibit to an invited party of railroad men and members of the press the new cars for the New York and Chicago limited trains, of which fifty-five are now building by the Wagner Company for the Vanderbilt lines. These cars are warmed by the hot-water circulating system of the Safety Car Heating and Lighting Company, which seemed to work very satisfactorily, although the weather was not cold enough to afford much of a test.

The Chicago, Milwaukee and St. Paul Railroad, having experimented with car-heating from locomotive with sat-factory results, will at once adopt the system for all through trains on its various lines.

A DRAFT KILLER.

Uhlands Wochenschrift states that the Carbonate of Soda Company, of Dresden, produce an apparatus designated as a zugtödter (draft-killer) which will prevent cold drafts of air at windows. The apparatus consists of an ornamental box fitted to go between the sashes of double windows. The box has openings and valves and contains a carbonate of soda preparation which is odorless and smokeless, and which absorbs the air that leaks in between the sashes from within the room and from without. The effect is to create a constant uniform temperature between the sashes of the double windows.

The apparatus is constructed on the principles established by Dr. Krücke, of Berlin. The German Society of Physicians has highly commended the zugtödter.

We learn from the Osterr Ingenieur und Architekten-Vereins weekly edition of November II that the Russian Government is about to send a "technical engineer" to the United States who will be permanently attached to the Russian Embassy. This is to be followed by similar appointments to all their foreign legations. We agree with our contemporary that this is an important move in the right direction, and should be followed by all governments. The duties of this engineer will be to announce at the earliest moment, to the home government, all important scientific and technical discoveries and enterprises. It is gratifying that the United States should have been selected for the first appointment.

THE newest thing in bearings for axle-boxes is vegetable parchment sheets on edge. Experiments are being made with such boxes in Germany, and they are reported to work very satisfactorily, perhaps partly owing to the fact that their construction allows the bearings to be thoroughly lubricated.

JAMES CARSON BREVOORT.

JAMES CARSON BREVOORT died December 7 at his residence in Brooklyn, N. Y. Born in New York City in 1818, he graduated from the Ecole Centrale des Arts et Manufactures, in Paris, as a civil engineer, and before returning to this country made a tour of the manufactur ing districts of England and studied carefully that country's system of railroad construction. During 1838 he was engaged at the West Point foundry, and in 1841 assisted as surveyor on the North-western boundary survey. The year following he accompanied Washington Irving, United States Minister to Spain, as private secretary and attache of legation. In 1845 he married a daughter of Judge Leffert Lefferts and settled in Brooklyn, where he has since resided. In 1847 he was a member of the Charter Commission, and later served on the Brooklyn Board of Education and as a member of the Constructing Board of Water Commissioners. In 1852 he was elected a trustee of the Astor Library, and served for twenty-six years subsequently, during the last two years as superintendent of the library. He assisted in 1863 in the formation of the Long Island Historical Society, of which he was the first president, holding the office for ten years. In the same year he was made a Regent of the University of New York and received the degree of Doctor of Laws from Williams College. He was a member of many learned societies, and ot literary as well as scientific tastes. He leaves a widow and one

GENERAL WILLIAM HEMSLEY EMORY.

BRIGADIER-GENERAL WILLIAM HEMSLEY EMORY, who retired from active military service in 1876, died at his residence in Washington December 1. He was born at Poplar Grove, Md., and graduated at West Point in 1831 with such high honors as to forthwith receive promotion as Brevet Second Lieutenant of the Fourth Attillery. Two years later he resigned, and after devoting himself to civil engineering the two ensuing years was reappointed First Lieutenant of Topographical Engineers. He was diligently engaged, until the breaking out of the Mexican war, in surveys on coast fortifications and in running the boundary between the United States and the British Provinces. He was Acting Assistant Adjutant-General of Kearny's expedition to California. He was brevetted Captain for brave and gallant services at the battle of San Pasquale, and Major for meritorious conduct in the battles of San Gabriel and Plains of Mesa. He was promoted Lieutenant-Colonel for his services in running the boundary line between the United States and Mexico. His notes on the military reconnoissance of the Arkansas and Gila Rivers and New Mexico and California show that he possessed no ordinary talent as a surveyor and scholar.

In 1855 he was appointed Major of the Second Cavalry and transferred to the First Cavalry, and until the breaking out of the rebellion was employed in frontier duty.

When the rebellion came he was on the Texas line, and a Confederate delegation requested him to follow the traitorous example of General Twiggs and surrender the command. "I will surrender only when I am whipped. The Confederates will have to do that before 1 surrender. Though a Southerner, I am no traitor. If you take me it will be as a prisoner, not as an ally." Such was his reply. Then with the troops at Forts Cobb, Smith, Washita, and Arbuckle, which he concentrated, he captured the advance guard of the rebel forces, and safely retreated to Fort Leavenworth, Kan. His prisoners were the first taken in the war, and his arrival at the post undoubtedly saved it and the State of Missouri.

In 1861 he was appointed a Lieutenant-Colonel of the Sixth Cavalry. In 1862 he was made Brigadier-General of Volunteers and took part in the Virginia-Pennsylvania campaign with McClellan. He was placed in command of New Orleans at a most critical time, and twice repulsed the notorious Dick Taylor at La Fourche Crossing. In 1863 he was in command of the Nineteenth Army Corps in the Red River campaign. In 1865 he was brevetted Major-General for services at Cedar Creek. He lived in Washington after his retirement, and leaves a widow, two daughters, and one son.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

OSHKOSH, WIS.—Plans and architects' estimates for a new public school building for the city of Oshkosh will be received for examination and consideration by the Board of Education until December 15. For information address C. W. Bowron, Chairman Building Committee.



For works for which proposals are requested see also the "Proposal Column," pages i-iii-viii-31.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and rel able news for our "Contract in Intelligence." Information of importance sent to us exclusively, and not eisewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

PASADENA, CAL.—The Mountain View Water Co., of Pasadena, has been incorporated. Capital stock, \$8,750. E. H. Royce can give information.

MARION, IOWA.—The Marion Water Co. has been incorporated. Capital stock, \$175,000. B. F. Seaton can give information.

PORTSMOUTH, VA.—Water-works will be in operation here soon.

SANFORD, FLA.—The water-works are to be improved.

GREENSBORO, N. C.—The proposition of Mr. Keogh to build water-works has been accepted.

FAIRCHANCE, PA.—The Fairchance Water Co. has been incorporated. Capital stock, \$5,000. William McCane, and others, incorporators.

PINE BLUFF, ARK.—A water-power company has been incorporated with a capital stock of \$150,000.

PORT PERRY, PA.— The Turtle Creek Valley Water Company has been formed to pipe the boroughs of Braddock and Port Perry, and the townships of Wilkins, Patton, and North Versailles. A pumping-station will be erected on the Monongahela River, near here.

NORTH BERWICK, ME.—This place is taking up a system of water-works.

ELLENTOWN, PA.—A stand-pipe 76 feet high will be erected here.

LITTLE CHUTE, WIS.—It is reported that water works are to be established here.

CONCORDIA, KAN.—It is expected that a system of water-works will be planted at Concordia before June, 1888.

BONHAM, TEX.—Our correspondent writes: "On the 21st inst. the City Council resolved to issue bonds for \$60,000, for the purpose of constructing water-works, and a committee was appointed to advertise for proposals to bore artesian wells and to negotiate for the placing of the bonds."

FOSTORIA, O.—Our correspondent writes: "The ordinance granting to Ferris & Halladay franchise to construct water-works was ratified by special election held on November 25, said firm to file an acceptance within thirty days."

FORT SMITH, ARK.—Our correspondent writes: "This city contemplates putting in a complete system of sewerage all over the city. The steps so far taken are: Mr. J. W. Neir, of Kansas City, was employed to recommend a plan and get up plans and specifications; these are now completed. As I understand it, it is the separate system, except as to some parts; main sewer for instance, which is brick, 3 feet 9 inches diameter. The City Council will now appoint three commissioners who will take charge of the work. They will first ascertain the entire cost, upon which the City Council will levy a tax sufficient to cover the amount.

This levy remains a lien upon all the real property of the entire city until it is paid. The Commissioners have the authority under the law to borrow ninety per cent of the entire levy and pay as high as ten per cent. interest. The wish and intention is to have it all laid and completed before the hot weather of next summer sets in."

CLARKSBURG, W. VA.—Our correspondent writes: "The supply will be taken from the West Fork of the Monongahela River, either through infiltration wells or galleries, and pumped into two steel tanks, each of 282,000 gallons capacity, located on one of the adjacent hills. The pumping machinery will consist of two duplex pumps of 500,000 gallons capacity each. There will be about 6.5 miles of pipe, ranging from 10 to 4 inches in diameter, of which 1.2 is 10 inches, force main from pumphouse to tanks. About thirty-one stop-valves from 10 to 4 inches; fifty-one 6 and 4 inch hydrants will be required. Plans and estimates are now being prepared by Mr. John W. Hill, Consulting Engineer, Cincinnati, O."

ITHACA, MICH.—Our correspondent writes: "There has been nothing done in regard to water-works as yet. There has been a committee appointed to investigate and see if a supply of water can be had, and if they are successful in finding plenty of water the village will undoubtedly put in a system of waterworks."

READING, PA.—Our correspondent writes: "We are at present looking out for some good reliable source to enlarge water-works, but as yet nothing decisive has been done, although something must be done this winter."

SAN BERNARDINO, CAL.—Our correspondent writes: "The steps taken by this city to establish water-works are that this city has granted a franchise to the Alta Water Company to pipe water into the city. The Water Company, I understand, to be now engaged building a reservoir preparatory to connecting their pipes with it,"

WEST SUPERIOR, WIS.—Answering an inquiry concerning water-works matters here, our correspondent writes: "We have about one mile of main laid; will suspend operations until spring; will lay about four miles of main then and about five miles of supply-pipe,"

CHATHAM, QUEBEC.—In answer to an inquiry concerning water-works here, our correspondent writes as follows: "No steps have yet been taken to establish water-works; those in favor are still agitating the matter. The Council of 1888 may look more favorably on the move. The new council goes in about Jacuary 15."

FULTON, Mo.—The special election held here November 29 resulted in favor of establishing water-works, and \$8,000 will be appropriated for that purpose. The sinking of an artesian well will be the first move made by the authorities.

LANSDALE, PA.—A sewerage system will be established here in the spring.

WAUKESHA, WIS.—An artesian well is to be bored here to secure a supply of water for the water-works system.

MINNEAPOLIS, MINN.—The question of enlarging the water-works continues to be discussed by the city officials. John A. Coley, the consulting engineer of the Water Department, has presented his report on the result of his recent investigation, and it is probable that steps toward the proposed improvement will soon be taken.

Dover, N. H.—At a recent special election the citizens of Dover voted to adopt the act passed recently by the legislature authorizing the purchase of the three aqueduct companies here and constructing new waterworks. The construction of the water-works will begin in the spring.

BROOKLINE, MASS.—At a recent meeting of the Common Council it was decided to ask the legislature for permission to appropriate \$500,000 for increasing the size and capacity of the water-works.

DES MOINES, IOWA.—The City Water Company has been incorporated with a capital of \$300,000. R. E. Hurley, J. W. McCabe, and others are the incorporators.

GRAND RAPIDS, MICH.—Our correspondent writes: "Proposition to bond the city for \$250,000 for water works improvements was defeated December 6. It is not known what further steps may be taken in regard to the matter."

SOUTH GRAND RAPIDS, MICH.—Our correspondent writes: "No definite plan has been formulated and made public at least for waterworks for South Grand Rapids. I think it is only a scheme announced to 'boom' this section of the city for speculative purposes."

JEFFERSON CITY.—It is reported that waterworks are to be established here. Mr. Perkins is said to be at the head of the project.

ALLEGHENY, PA.—The water committee has been ordered to take up the matter of a better supply of water for the city and will meet every Monday evening to discuss the question until some conclusion can be arrived at

CENTRALIA, ILL.—The special committee of the City Council appointed on water-works has made its report to the City Council. The committee was continued, and instructed to ask for bids for water works on the franchise plan. The adoption of the plans and their final adoption is to be left to a vote of the people.

SANDUSKY, O.—Our correspondent writes: "The Board of Water-Works will at once advertise for a new pumping engine of at least 5,000,000 gallons capacity daily. Charles A. Judson, City Engineer, can give details."

PAWTUCKET, R. I.—The sum of \$150.000 has been appropriated for a new pumping-engine at the water-works. Edward Darling is water works superintendent.

SANDUSKY, O.—This city will vote upon a proposition to issue \$32,000 in bonds for a new pumping-engine for the water-works at an early date.

HERRINGTON, KAN.—A water-works company has been established here and a system is to be built.

WAXAHACHIE, TEX.—Water-works are to be established here.

MINNEAPOLIS, MINN.—Holly pumps have been ordered put in at the Diamond Station.

FRESNO, CAL.—Bonds in the sum of \$100,000 are to be issued for a complete sew-erage system.

KEY WEST, FLA.—The Mayor of this city can give information concerning a proposed system of sewerage.

GLENDALE, O.—A system of water-works is to be established here.

STAFFORD SPRINGS, CONN.—A system of sewerage will soon be built here.

Weatherford, Tex.—A company has been organized to establish water-works here.

MISSOURI VALLEY, IOWA.—This town is to expend \$25,000 in a system of waterworks.

WILLIAMSTOWN, N. Y.—J. M. Waterman is at the head of a scheme to establish waterworks here.

Kentland, Ind.—It is reported that a large sum of money is to be invested in waterworks to be erected here.

WINFIELD, KAN.— The City Engineer has finished plans for a sewerage system, which is to cost the city \$190,000.

ATHENS, TENN.—Water works are to be built here soon.

ST. PAUL, MINN.—At a recent meeting of the Water Board it was decided to lay mains to Merriam Park for the purpose of supplying that place with water. The improvement will cost about \$89,000 and operations are to begin soon.

QUINCY, ILL.—It is probable that there will be some sewer construction here soon.

THE St. Cloud Water-Works Company, with a capital stock of \$150,000. The time of commencement has been set for December. Ic, and will continue thirty years. The incorporators are: E. D. Brown, H. W. Phelps, and others, all of Minneapolis.

DAYTON, KY.—Important developments in water-works matters may be expected here soon. The officials have decided for water-works and favor the "Mercer System," but nothing can be done until an act has passed the legislature allowing the town to contract for water.

ARCOLA, MASS.—This place is to have water-works, consisting of a huge tank placed on the top of a tower, and the water pumped in by a windmill from a reservoir.

TOPEKA, KAN.—The City Council has passed an ordinance authorizing the issuance of \$150,000 in bonds to purchase water power for the use of the city, and providing for a special election December 29.

WILLIAMSPORT, PA.—Our correspondent writes: "A general system of sewerage for the entire city is now receiving attention, and we hope to be able to let the work in the spring for the second and third districts. Estimated cost of same, \$115,000; to be paid for by property owners per foot front."

WINCHENDON, MASS.—Our correspondent writes: "A committee has been chosen to investigate the subject of water-supply and report at the annual towa meeting in March 1888."

Orono, Me.—Our correspondent writes:
"Water-works company organized under charter granted by Legislature. Title, "Orono Water Co.": D. N. Mayo. President; B. E. Donigan. Secretary; A. J. Durgin, Treasurer; and a Board of Directors. Committee appointed to confer with other companies as to the feasibility, and report at a subsequent meeting."

HAYWARD, Wis.—People of this place proposed to erect a system of water-works at the expense of the entire township, but an injunction restraining the village from prosecuting the work has been issued.

McKeesport, Pa. — The McKeesport Water Committee has awarded to the Worthington Steam Pump Company, of New York, the contract to erect a pumping-engine at a cost of \$19,500.

WINDSOR LOCKS, CONN.—In answer to an inquiry concerning the water-works project here, our corresponpent writes as follows: "We held a meeting and estimates were made as regards the cost of construction, and the success of the undertaking was almost fully assured. H. C. Douglas and E. D. Cougan were appointed a committee to locate the point at which water would be taken, and also determine the elevation. The works will probably be done by the company, or, if satisfactory arrangements can be made, with outside parties. We find we have sufficient elevation to give us all the water the town wants (by gravitation), without pumping. The incorporators are C. E. Chaffer, E. B. Bailey, H. C. Douglas, E. D. Cougan, S. B. Douglass, J. T. Coogan, A. W. Coursen, and J. W. Johnson.

ALLEGHENY, PA.—The water-works commissioners are discussing the question of placing new pumping machinery at their works.

FORT SMITH, ARK.—It is probable that an early conclusion will be reached in the matter of a system of sewerage for this city. Mr. Nier, at hydraulic and sanitary engineer of Kansas City, has perfected a detailed plan of the projected system upon which it is expected the city officials will take conclusive action within a week. It is reported that the system proposed will cost \$130,000.

LANCASTER, PA.—Our correspondent writes: "We are now building new water-works according to plans furnished by J. J. R. Croes, C. E., of New York City, putting in Worthington pumps, and four Babcock & Wilcox 100 horse-power boilers, raising the water about 170 feet to our present reservoir, at a distance of about one mile, through 3-foot pipes."

Owosso, MICH.—Our correspondent writes concerning water-works here: "The city has voted to bond itself for the purpose of putting in water-works. The Council has appointed a committee recently to look after carrying out the intent of said vote, and this is as far as we have proceded yet. I expect measures will be ripe for operations in the spring."



JAMFSTOWN, N. Y .- At a meeting of the Jamestown Water-Supply Company the report of Engineer Charles B. Brush was adopted to govern the actions of the company in building its new Levant system. The president was authorized to let the contract for building was suthorized to let the contract for building a pumping-station, the plan of which is at present being considered by Engineer Brush. The building will contain two 100 horse-power steel boilers, and a compound condensing pump capable of pumping and distributing 2,000,000 gallons of water daily. The tank or reservoir, which will be located on the highest ground in the city is to be 30 feet in diameter and high enough to contain 100,000 gallons, The supplies necessary for additional mains, etc., will consist of 1,600 tons of iron pipe, 25 tons of lead, and one ton of Russian hemp

CLEVELAND, O.—At a recent meeting of the Water-Works Trustees, Superintendent Whitelaw was instructed to immediately prepare plans and specifications for the new lake tunnel. The tunnel will be 30 feet below the bottom of the lake, 7 feet in diameter, and will cost about \$300,000. It will take nearly two years to complete the undertaking. two years to complete the undertaking.

FLORENCE, WIS -The village trustees have decided to build a pumping-works, and operate the water-works system itself in the future. It is hoped that the new plant will be completed by January t.

WASHINGTON C. H., OHIO.—Mr. Frank Johnson is agitating the establishment of a water-works system here. He writes us as follows: "The feeling has grown strongly in favor of water-works and we must have them. We have a population of between 5,000 and 6,000, growing all the time. Water-works will be as liberally patronized by our city as a corporation and as individuals. I will answer any inquiries and will introduce to our citizens any proposition. We have above 200 miles of free turnpike, four railroads, and the best of school buildings. Court-house, e.c., one soap WASHINGTON C. H., OHIO .- Mr. Frank school buildings, Court-house, e.c., one soap factory, two steam laundries, three shoe fac-tories, two marble shops, two planing mills, one creamery and other industries."

BRIDGES

OSHKOSH, WIS .- The County Commissioners will erect a \$20,000 bridge here.

EASLEY, S. C.—The County Commissioners will build a bridge over the Saluda River at this place.

OTSEGO, MINN.—The County Commissioners will build a bridge between Dayton and this city.

FULTONHAM, O .- The County Commissioners will build a bridge here.

CRUM LYNNE, PA. - The Philadelphia, Wilmington and Baltimore Railway Company will build a bridge at this place. Charles E. Pugh, Philadelphia, Pa., general manager.

MENOMINEE, MICH.—Our correspondent writes: "Our city and Marinette are going to build a bridge across the Menom nee River. S. M. Stephenson, Menominee, is the chairman, and will furnish any information asked

NEWARK, N. I.—At a recent meeting of the joint committee of the Essex and Hudson County freeholders it was decided to proceed at once toward erecting a bridge over the Passaic River, from this city to Kearny. Engineers Kelly and Owen, of the two counties interested, were instructed to prepare plans immediately. The proposed structure will cost from \$90,000 to \$110,000.

FORT WAYNE, IND.—Synopsis of bids for construction of bridge over the St. Mary's River, at Spy Run Avenue, opened December 6, by the Board of County Commissioners: Mt. Vernon Bridge Company, \$26,500. King Iron Bridge and Manutacturing Company, \$24,650. Smith Bridge Company, \$25,000. Cleveland Variety Iron Company, \$25,000. Columbus Bridge Company, \$24,000. Pittsburg Bridge Company, \$24,000. Masillon Bridge Company, \$23,000. Same company for plan No. 1, \$22,140. Same company for plan No. 2, \$21,500. Canton Wrought-Iron Bridge Company, \$24,600. It will be observed that the Massillon Bridge Company are the lowest bidders, and a contract will probably be closed with them. FORT WAYNE, IND. - Synopsis of bids for be closed with them.

JORDAN, PA.—The County Commissioners have decided to build two bridges here.

FREDERICK, PA.—The County Commissioners will build two bridges here.

DAYTON, O .- Address Eugene Shinn for details concerning two bridges to be erected

ST. AUGUSTINE, FLA.—A bridge across the Sebastian River, at Orange Street, is one of the talked-of schemes.

THE Niskey Hill Bridge Co., of Bethlehem, Pa., has been incorporated. Capital stock, \$10,000. Weston Dodson, George H. Meyers, and others, incorporators.

The Elizabeth Bridge Co., of Elizabeth, Pa., has been incorporated. Capital stock, \$25,000. W. W. O'Neil, W. D. O'Neil, and others, incorporators.

WHEELING, W. VA.—A bridge is to be erected over the Ohio River at this place by the Board of County Commissioners.

GRAND LAKE, COL.—It is reported that the County Commissioners intend to build two bridges here.

GAS AND ELECTRIC-LIGHTING.

MAUMEE, O.-C. C. Howells can give information of proposed gas-works here.

JACKSON, MISS.—Action will be taken early in January concerning establishing an electric-light plant here.

ASHLAND, KY.—An electric-light company has been organized, with E. M. Roberts, president; capital. \$10,000: A Waterhouse system, 30 light, full arc, for city lighting, and 30-light, full arc, 1,200 candle-power for 30-light, full arc, 1,200 candle-power, for commercial lighting, have been contracted for.

ALEXANDRIA, VA.—Efforts are being made by J. M. Hill to establish an electric-light plant here.

DAYTON, Ky. -The question of establishing gas-works is being agitated here.

YORK, PA .- This place is to be lighted by electricity.

Anna, Tenn.—An electric-light plant is soon to be established here.

JOHNSTOWN, N. Y.—Electric-lights are to be established here.

MADISON, N. Y .- Electric-lights are being agitated here.

BIG RAPIDS, MICH .- An electric-light plant is to be started here.

JAMAICA, N. Y.—The Long Island Electric Company has been organized, with a capital stock of \$100,000. J. Brown, Jr., and others, are interested.

FORT EDWARD, N. Y.—This town will soon be illuminated by electricity.

MEDINA, N. Y .- This town will have electric lights in running order by February I. It will take 40 lights at a cost of \$62.50 per light

THE Gas Consumers' Benefit Company organized at Portland, Me., with a capital stock of \$250.000. The stockholders are J. Rush Green, Somerville, Mass.; C. H. Fitler, Philadelphia, Pa., and others.

MANCELONA, MICH. — The Oval Wood Dish Co. will erect an electric-light plant at this place.

BIRMINGHAM, ALA. — The Birmingham Safe and Lock Co. will erect an electric-light plant in connection with their works at East

HAGERSTOWN, IND.—This city is agitating the question of electric-lights, and several plans have already been laid before the City Council. Important developments are expected soon.

RAILROADS, CANALS, ETC.

THE Kinderhook, Valatie and Stuyvesant Railroad runs from the new summer resort, Kailroad runs from the new summer resort, Kinderhook Lake Park at Niverville, on the Boston and Albany R. R., through Valatie and Kinderhook to Stuyvesant, on the Hudson River, a distance of ten miles, connecting at the latter place with the New York Central and Hudson River Railroad and the river steam-The amount of capital stock is \$150. boats. The amount of capital stock is \$150,-000; bonds also \$150,000, with 6 per cent. interest. Construction has just been commenced. Charles D. Haines, of 45 Broadway, New York, is the principal promoter of the enterprise, and Thomas Moore, of Elizabeth, N. J., has the contract for the work.

BIDS OPENED.

RALEIGH, N. C.—The amounts of the bids RALEIGH, N. C.—The amounts of the bids for heating public buildings, opened September 1 by W. P. Roberts, Auditor, are not made public. The following were the bidders: J. C. Brewster & Co., Raleigh, N. C.; Basshor & Co., Baltimore, Md.; Samuel I. Pope & Co, Chicago, Ill.; West Point E. and M. Co., West Point, Pa.; Walworth Mfg. Co., Boston, Mass, bid arrived too late to be considered; Kelly & Jones Co., Pittsburg, Pa. The contract was awarded December 2 to Kelly & Jones Co. Kelly & Jones Co.

NEW YORK CITY.—Synopsis of bids to build the new Sodom dam at Westchester County, opened December 7, by the Aqueduct Commissioners.

Commissioners.

There were fifteen bidders who offered to do work for the amounts which follow opposite their names: Sullıvan, Rider & Dougherty, \$306,990; Andrew O'Rourke. \$369,897; J. S. Brown, \$377,615; Page, Carney & Co., \$379,950; Ryan & McDonald, \$384,131; Smith, Ripley & Brown, \$430,360; John B. Quackenbush, \$438,515; Clarke & O'Hair, \$441,470; O'Brien & Clarke, \$442,270; Nolan Bros., \$447.060; R. A. Malone, \$465,370; Cose, John & Co., \$484,147; Jerry Byron, \$486,216; Henry Collins, \$486,910, and Arnold & Stephens, \$493,870. The lowest bidders are Sullivan, Rider & Dougherty.

FINDLAY, O. - Synopsis of bids for the construction of the following details of the Findlay Water-Works, opened November 28 by the Water-Works Trustees, John W. Hill, Consulting Engineer:

Storm-water grain	mprovement pumping-station grounds	suction condust (laying)	ing toundat ons	rump-wells, pumping-station, and build-	root-bridge	trate-chamber and bridge and pirr					ITEM.	
li .		552.00	16,347.56		150.97	959.80	11,070.30	9,346.00	12,012.07	\$56.709.36	Huston & Freeman, Cincinnati.	
7.737.75	299.53	1,656.ou	16.179.92	•	275.00					\$83,331 05	W. H. Campfield, Findlay, O.	
7,845.00		:	:		275.00	:	22,230.23		18,728.47	\$88.984.95	James Swisher, Urbana, O.	Bibi
	:	:::::::::::::::::::::::::::::::::::::::	16 179.92		:::::::::::::::::::::::::::::::::::::::	1,003.01	:::::::::::::::::::::::::::::::::::::::	9.331.22	37.473.07 18,728.47	\$98 023.72	F. Scanland & Co., Erie, Pa.	BIDDERS.
\$4,362.0	:	:::::::::::::::::::::::::::::::::::::::	:		:::::::::::::::::::::::::::::::::::::::	:	:	:::::::::::::::::::::::::::::::::::::::	::	:	William Noriis, Findlay, O.	
0,907.50 7.737.75 7,845.00 \$4,362.00 \$5,166.70		I,656.00	• • • • • • • •			-	:::::::::::::::::::::::::::::::::::::::	:	:::::::::::::::::::::::::::::::::::::::	:	George Weinkel, Findlay, O.	

Contract awarded to Huston & Freeman; total, \$185,766.79.

NEW YORK CITY. - Synopsis of bids for removing the existing pier, known as Pier 37, E. R., and for preparing and building a new wooden pier and approach on the same site wooden pier and approach on the same site and for repairing the existing crib bulkhead thereat, opened December 5 by the Department of Docks. The engineer's estimate included about 7,000 cubic feet new crib work, 3,500 cubic yards rip-rap stone and timber, furnishings, etc. The following were the bidders: John Gillies, \$30,105; Richard Cronin, \$30,500; J. W. Flaherty, \$29,215; P. Sanford Ross, \$28,575; John Monks, \$41,643. \$31,643.

CINCINNATI, O .- F. Kirchner & Co., this city, have secured the contract for the work known as the Gilbert Avenue Improvement, for the sum of \$18,667.60.

CLEVELAND, O .- The contract for the construction of a new Nypano double-track iron bridge across the river at Broadway has been let, and will be commenced at once. The new structure will be 220 feet in length.

COLUMBIA CITY, IND.—The contract for COLUMBIA CITY, IND.—I he contract to the erection of a new Court House for Whiteby County was not let, owing to various omis-sions in the specifications, and the Commis-sioners propose to revise them and advertise again.

BROOKLYN, N. Y.—Synopsis of bids for building engine-house in this city opened December 5 by George Ricard Connor, Commissioner: P. F. O'Brien, work complete, \$11,779; James Ashfield & Son, work complete, \$11,697; George W. Williams, work complete, \$10,732; Leonard Brothers, work complete, \$10,680; John T. Hanlon, bid informal bid informal.

McKeesport, PA .- Synopsis of bids for McKeesport, Pa.—Synopsis of bids for furnishing a 5,250,000-gallon duplex, compound, direct-acting pumping-engine, 48 inch stroke, opened December 1 by the Water Department: Wilson & Snyder, Pittsburg, Pa., \$20,412; Deane Steam Pump Co., Holyoke, Mass., \$24,000; Knowles Steam-Pump Co., New York City, complete, \$25,000, without reheater. \$23,333; Worthington Steam-Pump Co., New York City, complete, \$20,500, without cut-off valve, \$19,500.

WILLIAMSPORT, PA.—Contract just closed by the city with E. Dunbar for paving 40,000 square yards of street with the macadam pavement at \$1.40 per yard.

ELIZABETH, N. J.—Synopsis of bids for lighting the streets of the city for one year, opened by the Common Council December 1: The Schuyler Electric Company proposed to The Schuyler Electric Company proposed to furnish the arc lights now in use at from \$100 to \$120 per year, the difference in price varying in the hours burning each night. The company also proposed to furnish incandescent lights for \$16.50 and \$17.50 per annum, the latter to burn from sunset to sunrise. The New York and New Jersey Globe Gas-Light Company proposed to general is contract for Company proposed to renew its contract for 500 lamps or more, with new and improved 500 lamps or more, with new and improved lantern, to burn each night until one o'clock, for \$17 per one year, and \$16.50 for three years per lamp. Lamps to burn until sunrise for \$18.75 for one year, and \$18.25 for three years. In addition, it was agreed to furnish extra lamp posts, if desired, without cost. The proposals were referred to the Committee on Lights with instruction to make recommendation at an adjourned meeting. tion at an adjourned meeting.

GOVERNMENT WORK.

BALTIMORE, MD.—Synopsis of bids for labor and material for placing plumbing and gas-piping in Post-Office, opened December 1 by the Supervising Architect of the Treasury

by the Supervising Architect of the Treasury Department:
Samuel I. Pope, \$30,970.
L. O. Howell, Jr., \$27,300.
G. W. Walther, \$27,030.67.
Charles G. Carmine, \$19,900.
John Trainor, \$29,999.99, cast-iron soilpipe, \$34,999,99, wrought-iron soil-pipe, \$34,999,99, wrought-iron soil-pipe.
James A. Mundy & Bro., \$19,989.
Crook, Horner & Co., \$18,116.
Geo. Knipp & Bro., \$29,193.

PORT TOWNSEND, WASH. T .- Synopsis of PORT TOWNSEND, WASH. 1.—Synopsis of bids for masonry, iron and carpenter work, to top of second floor of Court-House, opened November 30 by the Supervising Architect of the Treasury Department:

Bidders.	Stone Facing.	Brick Facing.					
Joseph L. Middlebrook	30,620	26,500					

NEW INCORPORATIONS.

The Newman Anti-Freezing Water-Pipe Co., of Chicago, has been incorporated; capital stock, \$250,000. Edwin A. Newman, M. S. Hopkins, and others, incorporators.

THE Buffalo Illuminating Co., of Buffalo, N. Y., has been incorporated; capital stock, \$100,000. Daniel E. Bailey, C. E. Clark, and others, incorporators.

THE Roodhouse Electric and Power Co. of Roodhouse, Ill., has been incorporated; capital stock, \$5.000. Ellis Briggs, Frank M. Bateman, and others, incorporators.

THE Presque Isle Electric-Light Co., Presque Isle, Me., has been incorporated; capital stock, \$10,000. James W. Bolton and Sidney Graves, incorporators.

THE Western Electric Light Co., of St. Louis, Mo., has been incorporated; capital stock, \$60,000. F. L. Johnson and others, incorporators.



THE Union Light and Fuel Gas Co. of America, of Chicago, Ill., has been incorporated; capital stock, \$5,000,000. N. J. Haven, A. J. Park, and others, incorporators.

THE Port Chester Standard Gas-Light Co., of Port Chester, N. Y., has been incorporated; capital stock, \$150,000. Charles H. Jackson and Charles F. Street, of New York, and others, incorporators.

THE Beaver Gas and Oil Co., of North Lima, O., has been incorporated; capital stock, \$5,000. Obadiah Dutterer, Samuel H. Coles, and others, incorporators.

THE Matilja Water Company. The object is to supply water to the Eggers tract and to other land in the Ojai Valley. The directors are Joseph Hannon, J. E. Fulton, and others; capital stock, \$500,000.

THE La Canada Land and Water Company. Its principal office will be at Pasadena. The directors are H. H. Lenville, Jesse Knight, and others; capital stock, \$200,000.

THE Rockford Electric Power Company, of Rockford, Ill.; capital stock, \$30,000; object, the generation of electricity for power and illuminating purposes; incorporators, John Bartlett, John W. Bartlett, A. S. Bartlett.

THE Sun City Water Power Company, of Sun City, Kan., has been incorporated with a capital of \$35,000. Directors: Daniel Corune, F. A. Whitaker, and others.

THE Lewisburg Electric Light Co., of Lewisburg, Pa., has been incorporated. Capital stock, \$15,000; Cyrus Hall, George S. Matlock, and others are incorporators.

THE Stillwater, Minn., Natural Gas and Oil Company, with a capital stock of \$50,000. Its purpose is to drill for gas and oil and lay and maintain necessary pipes. The incorporators are: E. W. Durant, John McKusick, and others, all of Stillwater.

THE North-Western Modern Car-Heating Company, of St. Paul, Minn. The capital stock is placed at \$1,000,000. The incorporators are: T. B. Mills, Millston, Wis.; W. M. Klinefelter, St. Paul, and others.

THE Minneapolis Electro-Matrix Company. Capital stock, \$1,000,000. Incorporators: George H. Goodson, Alexander S. Capehart, and others, all of Minneapolis.

THE Choctaw Coal and Railroad Company, of Minneapolis, Minn., with a capital stock of \$2,500,000. The incorporators are: G. B. Kirkbride, J. A. Wolverton, and others, of Minneapolis,

THE Chicago Paving and Post Co., of Chicago, Ill., has been incorporated. Capital stock, \$50,000. William Ripley, Edward E. Ayer, and Henry A. Christy, incorporators.

JACKSONVILLE, FLA.—The Florida and Georgia Air-Line Railroad Company has been incorporated. Among its incorporators are Joseph F. Dean, Oliver W. Bronwell, late General Passenger Agent of the Florida Southern, and James A. Larnerd, its present General Superintendent, all of Palatka. Fla.

THE Porter Ditch and Irrigation Co. has been incorporated at Denver, Col., by J. S. Porter, W. E. Tryon and others. Capital stock, \$3.600. The Mohawk Canal Co., of Porter, W. E. stock, \$3,600. Yuma, Ariz., will excavate twenty miles of canal; the work to be completed in December, 1888. George W. Norton is Engineer. The North Star Land and Canal Co. has been incorporated at Del Norte, Col., to take water from the Rio Grande seven miles below the city.

THE United States Automatic Electric Protector Co., of Camden, Pa., has been incorporated. Capital stock, \$150,000. Thomas A. D. Forster, Samuel P. Hanson, Norristown, Pa, and others, incorporators.

THE Eno Steam Generator Co., of Newark, N. J., has been incorporated. Capital stock, \$350,000. Matthias Plum, Ira W. Conselyea, Newark, and others, incorporators.

THE City and Suburban Transit Company, Council Bluffs, Iowa. Capital stock. \$50,000. F. O. Gleason, and others, incorporators.

THE New England Gas-Lighting Company, Portland, Me. Capital stock, \$500,000. Nathaniel H. Shaw, and others, incorporators.

THE Durango, Cortez, and Salt Lake Railroad Company, Durango, Col. Capital stock, \$100,000. F. L. Kimball, and others, incor-

The Newport and Yaquina Railway Company, Newport, Ore. Capital stock, \$100,000.

A. J. Ray, and others, incorporators.

THE United States Electric Railway-Signal Company, Ashland, Ky. Capital stock, \$500,000. John H. Crook, and others, incorporators.

THE Burlington, Stillwater and Duluth Railroad Company, Duluth, Minn. Capital stock, \$3,600,000. E. W. Durant, and others, incorporators.

THE El Paso and Northeastern Railway and Telegraph Company, El Paso, Tex. Capital stock, \$30,000. H. L. Detwiler, and others, incorporators.

THE Metropolitan Street-Lighting Company, Cincinnati, O. Capital stock, \$50,000. William Glenny, and others, incorporators.

THE Mount Vernon and East Chester Railway Company, Mount Vernon, N. Y. Capital stock, \$60,000. W. R. Bergholz, and others, incorporators.

THE South Pittsburg Power Company, of Pittsburg, Pa., has been incorporated. Capital stock, \$10,000. J. W. Patterson, J. O. C. Campbell, of Knoxville, and others, incor-

THE Armstrong County Gas Company, of Kittanning, Pa., has been incorporated. Capital stock, \$3,000. Ross Reynolds, Jr., and W. D. Patton, Kittanning, and others incorporators.

The Citizens' Light and Fuel Company, of Millerstown, Ala., has been incorporated. Capital stock, \$10,000. Austin Fleeger, J. C. Gaisford, and others, incorporators.

THE Anniston Gas-Light Company, of Anniston, Ala., has been incorporated. W. G. Ledbetter, O. H. Parker, and others, incorporators.

THE Topeka Belt Railway Company, of Topeka, Kan., has been incorporated. Capital stock, \$1,000,000. F. R. Cordley, C. L. James, Boston, Mass., and others, incorpora-

THE Lake Valley Railroad Company, of San Francisco, Cal., has been incorporated. Capital stock, \$20,000. H. M. Yerrington, G. F. Ford, Carson, Nev., and others, directors.

THE Fresno City, Belmont, and Yosemite Railroad Company, of Fresno City, Cal., has been incorporated. Capital stock, \$500,000. E. C. Winchill, William R. Thomas, and others, directors.

THE Baltimore, Grafton, and Charleston Railway Company, of Grafton. W. Va., has been incorporated. Andrew Pearre, F. J. Harmison, and W. M. Clements, of Baltimore, Md., incorporators.

THE Minneapolis Subway Company, of Minneapolis, Minn., to build and operate underground conduits for the use of all sorts of electric telephone, telegraph wires, gaspipes and the like. The corporation is to commence December 1, 1887. The capital is \$300,000. The incorporators are R. P. Russell, C. H. Prior, and others.

THE Minnesota and Northern Railway. The capital is placed at \$5,000,000, and the incorporators are C. H. Smith, Daniel Shell,

THE Central Indiana Railway Company, Terre Haute, Ind. Capital stock, \$100,000. Lewis J. Highland, and others, incorporators.

THE Citizens' Railway Company, Buffalo, N. Y. Capital stock, \$150,000. A. P. Wright, and others, incorporators.

THE Visalia and Tulare Railroad Company, Visalia, Cal. Capital stock, \$100,000. J. Goldman, and others, incorporators.

THE San Diego Cable Car and Land Company, San Diego. Cal. Capital stock, \$250,000. M. B. Kellar, and others, incorpora-

THE Southern California Motor Road Company, San Bernardino, Cal. Capital stock, \$1,000,000. Samuel Merrill, and others, incorporators.

THE Thomson-Houston Electric-Light Co of Baltimore City, Md, has been incorporated. Capital stock, \$200,000. S. H. Taggart, G. R. Berry, and others, incorporators.

THE Mentone Irrigation Company, of Los Angeles, Cal. It proposes to develop water from Mill Creek Wash in San Bernardino County. The directors are S. H. Marlette, A. G. Hubbard, and others. Capital stock, \$400,000.

THE Mountain View Water Company, of Los Angeles, Cal. The object is to acquire and develop water in the Little Negro Canon. The directors are E. H. Koyce, L. W. Giddings, and others. Capital stock. \$8,750.

THE Long Beach Railroad Company, Los Angeles, Cal. Capital stock, \$100,000. E. B. Cushman, and others, incorporators.

MISCELLANEOUS.

MONTREAL, CANADA. — The Canadian Pacific Railway Company has decided to bring in the tracks from Grey Street to the Windsor Street Station on a stone viaduct 26 teet wide.

MEMPHIS, TENN.-There is talk of building a levee seventeen miles long, from Hickman to Tiptonville, to cost \$140,000, which is to protect from overflow 38,000 acres in Ken-tucky and 15,000 acres in Tennessee.

SOMEBODY has been kind enough to send us a copy of the Fremont Daily News, Board of Trade edition, evidently issued to boom the City of Fremont, the home of Ex-President Hayes. Its leading citizens, public buildings, and warehouses are fully illustrated, the issue containing over ninety illustrations.

PROPOSALS.

(Continued from page viii.)

ENGINE-HOUSE.—Bids wanted at Baltimore, Md., until December 10. Building to be 25x110 feet, two stories. Address Theodore Oster, Building Inspector.

GRADING, EXCAVATING, ETC.—Proposals are wanted at Peckskil, N. Y., for grading, excavating rock and earth, filling in roads and ravines, and building retaining-walls, culverts, etc. Until December 16, Address communications to the Commissioners, State Arsenal, Thirty-fifth Street and Seventh Avenue, New York City.

ENLARGING DRILL-HALL,—Proposals wanted at Brooklyn for enlarging the drill-hall of the State Armory, and other work in connection with the same. Until December 12. Address Commissioners, State Arsenal, Thirty-fifth Street and Seventh Avenue, New York City.

STEAM-HEATING.—Proposals wanted at Iuneau, 71s, for furnishing apparatus, material and labor for eating Dodge County Court-House by steam. Untilecember 14. Address Louis Rushlow, Chairman ommittee on Public Building.

BRIDGE.—Proposals are wanted at Savannah.Ga., until December 22, for rebuilding bridge and keeping it in repair for seven years. Address John R. Dillon, County Commissioners' Clerk.

WROUGHT-IRON PIPE, ETC.—Proposals are wanted at St. Louis, Mo., until January 5, for furnishing lime, breck, cement, lumber, hardware, wrought iron pipe, vitrified pipe, and fittings, etc., as enumerated. Address James M. Moore, Deputy Quartermaster General, U. S. A., Depot Quartermaster.

SEWERS.—Proposals for sewers and street-work are wanted at Rochest r, N. Y., until December 13. Address T. J. Nevill, Clerk.

BRIDGE.—Proposals are wanted at Buffalo. Minn., for building a bridge over Crow River, to be 250 feet in length. Until December 16. Address William Ziebarth, Commissioner, Wright County, Minn.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; is dwell, brown-stone dwelling; apart house, apart neithouse: fen, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

31 Pell, br ten and stores; cost, \$12,000; o, Dora Sokolsky; a, F Ebeling

123 Baxter, br ten; cost, \$20,000; o, August Ruff; a, Kurtzer & Rohl

Pitt, e s, 80 s Broome, br ten; cost, \$12,000; o and b, John Totten; a, G B Pelham

\$704-08 10th av, br stores and factory; cost, \$50,000; o, R A Wallace; a, Henry Davidson

72d st, s w cor 4th av, 4 stone dwells; cost, each, \$28,000; o, a, and b, McCafferty & Buckley

4th av, ws, 68.2 s 72d st, br dwell; cost, \$25,000; o, a, and b, same as last

127th st, s s, 225 w 6th av, 2 s and br tens; each, \$30,000; o, Max Rodding; a, Chas Baxter

190 Delancy, rear, br wk shop; cost, \$8,000; o, Tobias Krakower; a, Rentz & Lange

S s 98th, 125 e 10th av, br flat; cost, \$22,000; o, Wellman Watts; a, not given.

253-257 W 17th, br factory: cost, \$40,000; Knickerbocker Brewing Co; a, James J

34 Hudson, br dwell and store; cost, \$15,-000; o, H C West; a, J C Babcock.

ALTERATIONS-NEW YORK.

575 Broome, br dwell; cost, \$7,000; o, Mauria Ahern; a, J B Franklin.

BROOKLYN.

Atlantic av, n w cor Schenectady av, brick police station; cost, \$23,000; o, city; b, J Cashman and J Hanlon

Rapelye st, s cor Richards, br police station; cost, \$23,000; o, a, and b, same as last

S s 13th, 97 e 7th av, 3 brick dwells; cost, \$15,000 all; o, S B Pulton; a, Wirth.

W s Lee av, 53 s Clymer st, br Civil and Police Court-House: cost, \$22,000; o, city of Brooklyn; a, Robert Van Buren.

Cor Lee av and Clymer st, br police station; cost, \$29,000; o, City of Brooklyn; a, not

N s Wilson st, 74 e Kent av, br dwell; cost, \$8,000; o, Fred Tegge; a, Th Engelhardt.

Se cor Cook st and Evergreen av. 6 frame dwells; cost. \$27,000 all; o, Leopold Michel; a, same as above.

56 Ten Eyck, fr dwell: cost, \$7,200; o, T L Neff; a, same as above.

N w cor Suydam st and Hamburg av. 2 fr dwells; cost, \$9,000 all; o, A Fleischmann; a, Ludwig Hetzelt.

N e cor Franklin av and Carroll st, 7 frame dwells; cost, \$35,000 all; o, Chas Graf; a, John Platte

N w cor Jackson and Humboldt, 5 frame dwells; cost, \$15,000 all; o, Jacob Rauth; a, a, John Platte

243 Plymouth st. fr factory; cost, \$7,500; o, Oliver P Ingersoll; a, Amzi Hill.

MISCELLANEOUS.

HARTFORD, CONN.—A public building, to cost \$15,000, is to be erected in this city. C B Andrews is one of the Building Com-

SUTTER CITY, CAL.—A \$10,000 hotel is to be built here.

HOLYOKE, MASS .- Catholic church; a, J Murphy, Providence, R I.

BOSTON, MASS.—Townsend, wood dwell; cost, \$7,500; o, Francis Todd; a. J W Beal; b, F J Tobin.

136-142 St Botolph, 4 brick dwells; cost, \$0,000 each; o, F A Johnson and others; b, S E Potter.

140-142 Huntington av, 2 brick dwells, cost. \$12,000 each; o, H H Fitch; a, E N Boyden; b, J E Potter.

277-285 West Chester Park, 5 br aparts; cost, \$22,000 each; o, Peter Graffam; a, F Griffin; b, owner.

287-293 West Chester Park, 4 br aparts; ost, \$20,000 each; o and a, Thomas R cost, \$ White.

204-210 West Chester Park, 4 br aparts; cost, \$12,000 each; o, a, and b, Albion Kowlton.

MILWAUKEE.—Se cor E Water and Mason sts, alterations and repairs. Kirby House; cost, \$5,000; o, Abner Kirby.

W s of 3d st, s of Grand av, 6-story mar-ble theatre; cost, \$200,000; o, Davidson & sons; a, Burnham & Root.

Kinnickinnic av and Dover st, br church; cost, \$14,000; o, Evangelical Lutheran So-

3d st s of Grand av, extension of Euro-ean Hotel; cost, \$10,000; o, J Schlitz Brewing Co.

Soldiers' Home, br restaurant and soloon; cost, \$10,000; o, United States Government; H C Koch and others have presented plans.

Martin st, u w cor of Milwaukee, br addn 45x60; cost, \$5,000; o, Welsh Presbyterian church.

Cor Park st and 5th av, br factory; cost, \$7,000; o, Koll Mfg Co; a, E T Mix & Co; b. I Bently.

16 new buildings less than \$7,000.

TROY, N. Y.—The Troy Club will erect a \$40,000 building.

ATLANTA, GA.—Gould & Van Dyke will erect a \$75,000 office building.

CAPE MAY, N. J .- The Mount Vernon Land Company will soon erect a \$20,000 hotel at this place.

SOMERVILLE, MASS.—The Free Mass of this place will erect a \$30,000 temple. The Free Masons

BUILDING INTELLIGENCE.

CHICAGO, ILL.—490-92 Clark, br st and flats; cost, \$15,000; o, J B Waller; a, E. Baumann; b, Lotz & Thomson

185-87 California av, br flats; cost, \$8,-00; o, Hy Sweet; a. T Bell; b, H Sweet

253-61 Elston av, br factory; cost, \$30,-00; o. Hall, Ross & Co; a, W L Carroll; b, B G Robinson

1005-07 W Harrison, br st and flats; ost, \$10,000; o. M Innes; a,I C Hettinger; b, Findlay & Drysdale

239-41 N Curtis, br flats; cost, \$8,000; o and a, A W Wolff; b, H Rassmassen
3001-03 Cottage Grove av, br st and flats; cost, \$18,000; o, F Messick; a, P Hale; b, A Dressel

254-56 N Market, br st and flats; cost, \$10,000; o and b, H F Lundgren; a, Ostling Bros

3840 Vencennes, br dwell; cost, \$12.000; o, E F Simonds; a, W Thomas; b, F Guerra & Co

1223-25 Wabash av, br st and flats; cost, \$10,000; o, F L Brand; a, C M Palmer; b, Barney & Rodatz

265-269 Lincoln, br flats; cost, \$12,000; Browa & Linquist; a, H Copeland; b, o, Browa & Linqu Voght & Douglas.

3700 Lowe av, 3-story br school; cost, \$40,000; o, Church of Nativity; a, J Donnellan; b, E Slatterer.

583-593 W Madison, br store and flats; cost, \$18.000; o, Peter Brooks.

3815-17 33th. br flats; cost, \$10,000; o, Geo Allan; a. J H Carpenter; b, owner.

3213-19 Rhodes av, br dwell; cost, \$40,-00; o, G F Harding; a, W W Clay; b, J I Maloney.

3123-31391/2 Vernon av, br dwell; cost, \$33,000; o, a, and b, same as above.

FORT WAYNE, IND.—Mr H W Watson,

office building for the Rich B others.

Messrs. Wing & Mahurin, architects, have prepared plans for St. Paul's German Lutheran Church to cost \$75,000; asylum for feeble-minded youth to cost \$40,000, and a block for Pixley & Long, \$50,000.

READING, PA .-- Contracts will soon be made for completing the Government build-ing in this city, which has been in an un-finished condition for some time.

SAN FRANCISCO, CAL.—Buildings to cost \$150,000 for the Pacific branch of the National Soldiers' Home are to be erected here.

MINNEAPOLIS, MINN.—C C Dunn will build a \$30,000 block on Nicollet av

James McKinney will build a \$12,000 hotel in the same vicinity

SPRINGFIELD, MASS.-Mattoon street, br block of 3 tens; cost about \$15,000; o, L C Smith; a, F S Newman

ST. PAUL, MINN.—4th, nr Wabasha, 2-story br theatre; cost, \$75,000; o, Sockett & Wiggins

MOUNT VERNON, N. Y.—An armory for the Eleventh Separate Company is to be erected by the County Commissioners.

BANGOR, ME .- The Odd Fellows will put \$40,000 in a new edifice.

ST. JOSEPH, MO.—A hotel, to cost \$125,-000, is to be built here by Jacob Gieger.

BURLINGTON, VT .- St. Francis' Church congregation will erect a church to cost \$100,000.

ST. LOUIS. MO .-- Address John R Lionberger for details of \$300,000 building.

UTICA, N. Y.—A Druiding, architect, 27 Metropolitan Block, Chicago, Ill., has plans church to cost \$80,000, which will be built here.

CHICAGO, ILL .- The Third Unitarian Society will build a \$20,000 church.

KANSAS CITY, MO.—The First Lutheran

Church Society is to erect a new church to

cost \$55 000. TRENTON, CANADA.—A Gobiel will give full details of the post-office building to be erected in this city.

ST. JOHNSBURY, VT. - A Y M C A building, to cost \$50,000, is shortly to be erected here.

BUILDING INTELLIGENCE.

ASHLAND, WIS .- Plans of a large union depot have been sent to local contractors for estimates. The building is to cost \$100,000.

KNOXVILLE. TENN .-- M E Thompson will build a hotel to cost about \$40,000.

CORSICANA, TEX.-The Board of Managers will shortly advertise for bids for building the State Orphan Asylum. James Garrity can give particulars.

WALTHAM, MASS.—It is probable that an almshouse will soon be erected here; \$21,000 has been appropriated for that pur-

TOMAHAWK, WIS. — The Tomahawk Lumber Co will build a lumber mill, and the Tomahawk Land and Boom Co will construct a dam. costing \$350,000. W. H. Bradley, of Milwaukee, is at the head

KAUKAUNA, WIS,-The Union Pulp Co will build a new \$70,000 pulp mill, and the Kelso Pulp Co will build an \$8,000 pulp mill, to replace those destroyed by fire November 23 last.

EUGENE CITY, ORE.—A new court-house and jail is to be erected here soon.

SIOUX FALLS, DAK .- Douglas & Stewart, formerly of Cedar Rapids, Iowa, will erect here a large oatmeal mill.

A CROSSE, WIS .- The Common Council is considering a resolution appropriating \$12.000 for the election of a public market-

PLATTSBURG, N. Y .- It is probable that a new court-house will soon be erected here.

SIOUX CITY, IA.—An Industrial Orphans' Home, to cost \$100,000, is talked of here.

SAN FRANCISCO, CAL .- J T Washington, secretary, will give details of work to be done on the City Hall building in this city, for which sealed proposals are invited.

WHITEFISH BAY, WIS.—Address Captain Pabst, Milwaukee, for details concerning a large hotel which he will erect nere.

OMAHA, NEB .- A new Federal building is

SALT LAKE CITY, UTAH.—A large addition to the Utah penitentiary is projected.

EAU CLAIRE, WIS .- The county officials are considering plans for erecting an asylum for chronic insane.

STILLWATER, MINN.—St Croix Lumber Co will spend \$10,000 improving lumber mill.

MILWAUKEE, WIS .- Waushara County votes to appropriate \$10,000 for a new court-house.

NEWPORT, KY. - Messrs. Crapsey & Brown, of Cincinnati, architects, have been engaged to prepare plans for a new jail, the cost of which is not to exceed \$40,000. The object of the Court-House Commissioners is to get the estimated cost so that an act authorizing the issue of bonds for that amount may be passed by the coming Legislature.

DULUTH, MINN.-Blast furnace, rolling mill, and linseed oil warehouses are talked

HARVEY CO., KAN, -A court house to cost \$75,000 is to be erected here.

WILLIAMSPORT, PA .- The Board of Education will erect a new central high school building. It will have a height of 70 feet and a tower 110 feet; cost, \$35,000; A L Wagner, architect.

OIL CITY, PA,—Father Carroll will give details of the \$50,000 Catholic church to be

McCOMB, OHIO.—A school-house is to be erected here to cost \$30,000. Address Architect Wyss, Findlay, Ohio.

LANSDALE, PA .- A large stone building is to be erected here for the manufacture of the Edgerton Electric Motor. Address Prof F H Edgerton.

BUILDING INTELLIGENCE.

ALBION, MICH .- The Methodist Society has voted to build a \$25,000 church.

RACINE, WIS .- It has been decided to appropriate \$40,000 for an insane asylum in Racine County.

VERNON, WIS -- Vernon County Board of Supervisors bonds the county for \$35,000 to raise an insane asylum fund.

AUSTIN, TEXAS .- This city is to have a new depot to cost about \$23,000. Address Pete Lawless, R R agent, this city.

MILWAUKEE, WIS .- Paul Bechtner, one of the trustees of the proposed new \$60,000 hospital for this city, can be addressed regarding same.

PHILADELPHIA.—Clothier, bet Germantown av and Cedar st, 9 2-story dwells; b, Jas B Carey

Hope, n Cambria, 10 2-story dwells; b, Jas E Campbell

Morton, bet Washington Lane and Duval st, 2 dwells; b, John Breedling

Pominia Terrace, bet Hancock and Morton, 2 dwells: b, same as above

Margaretta, bet Edmund and Courtland, 5 2-story dwells; o, Charles Stuckler

Broad and Clearfield, br factory; o, Jos N Pattison

928 N 3d st, 4-story br factory; b, H R Lentz

Roxborough, bet Freeland and Peachin, 4 2-story dwells; b, Howard R Yocum

ALMA, WIS .- The County Commissioners will erect a \$20,000 court-house here.

FLORENCE, ALA.—Two factories are to be erected here. Address J. B. White.

FORT WORTH, TEXAS.—J. J. Kane can furnish details concerning a Catholic church to be built here at a cost of \$60,000.

DANBURY, CONN.—The National Bank will erect a new building to cost \$25,000.

JERSEY CITY, N. J.—The Board of Free-holders will build a hall of records in connection with the court-house; cost, \$30,000.

PHILADELPHIA.-A new Jesuit college is to be built here, to occupy an entire block Estimated cost. \$300,000.

LINCOLN, NEB .- The bids for the new court house were too high, and new plans and bids will be advertised for immediately.

BALTIMORE, MD.—It is reported that Robert Garrett is to erect a hotel here seven stories high at a cost of \$500,000.

KANSAS CITY, MO .- The Hyde Park Club will erect a \$50,000 structure. Ad Messrs. Conkling, Mastin and Morse.

JOLIET, ILL .-- A Y. M. C. A. building, to cost \$20,000, is soon to be built here. details address J A Henry.

TERRE HAUTE, IND.—A distillery to cost \$200,000 is to be erected here by the Wabash Distilling Co. Address Crawford Fairbanks, of the above concern.

MORRISTOWN, N. J.—St. Peter's Parish is to have a new church which will cost

LOS ANGELES, CAL.—It is reported that a \$410,000 court-house is to be erected here.

FALL RIVER, MASS.—A new yarn mill with 20,000 looms and a capital of \$200,000 is to be erected here. .

WATERTOWN, D. T .- A church to cost \$25,000 is to be erected here.

DENVER, COL.-Address Gov. Evans for details of a \$60,000 church to be built here.

KANSAS CITY, MO.-Architects, Schrage & Nichols have plans for the Brown ladies' seminary at Manhattan, Kan., to cost \$75,-

BUFFALO, N. Y.—A school house, to cost \$10,000, will soon be erected here. Architects C K Porter & Sons, American Block, can give details.

WORCESTER, MASS.—Main, fr dw; cost, \$5,000; o, L D Thayer; a, S C Earle; b, C A Vaughan.

BUILDING INTELLIGENCE.

WILLIAMSPORT, PA.—401 W 4th, s dw; cost, \$28,000; o, A D Hernance; b, D Stempfle.

705 W 4th, br dw; cost, \$20,000; o, E A Rowley; b, G Waltz.

717 W 4th, br dw; cost, \$12,000; o, Chas Massina.

1023 W 4th, br dw; cost, \$10,000; o, J

702 W 4th, Catholic church; cost, \$80,000; b. G. Waltz.

531 W 4th, br dw; cost, \$12,000; o, A A Cahill.

W 4th, granite post office; cost, \$250,000; o. U S Government.

211 W 4th, br dw; cost, \$35,000; o, Y M C A; a, A S Wagoner; b, G Waltz.

637 W 3d, br public school; cost, \$35,000; a, A S Wagoner; b, D Stempfle

775 W 3d, br dw; cost, \$10,000; o, John Price.

Erie av, br dw; cost, \$20,000; o, Williamsport Decorative Co; addition to works. There are about 35 or 40 buildings in course of construction costing \$7,000 and

less. WATERTOWN, DAK .- Methodist Church

Society will build a \$25,000 church.

NEW HAVEN, CONN .- Liberty st, s addn; cost, \$15,000; o, Church of Sacred Heart.

Park, nr Chapel, br dw; cost. \$7,000; o, Chas H Webb.

Church, nr George, br st; cost, \$18,000; Wallace B. Fenn: a, Henry Austin; b, L V Treat & Son.

Chapel, nr Park, br dw; cost, \$10,000; o, Chas H Webb; b, same as above.

Orange, nr Trumbull, br and s dw; cost, \$25.000; o, W W Converse; b. C. Kinney. Orange, nr Bishop, br dw; cost, \$10,000; o, Jas G Beecher; a, R G Russell; b, Bates & Townsend.

Wall, cor York, br blk; cost, \$14,000; o, Mrs Mary E Pratt.

LOWELL, MASS.—Middlesex st, fr house; cost, \$8,000; o; F P Spalding; a, F W Stickney; b, C F Varnum

Cor Central and Charles sts, br ten block; o, W B Spalding; b, C P Barclay

ST. LOUIS, MO.—Grattan and Carroll sts. 8 adj br dwells : cost, \$10,000; o, L. Luth; b. Kluthe & Baker

17th and Franklin avs, br store and dwel; cost, \$14,000; o, S Simmons; b, F C Bon-

SACRAMENTO, CAL.—The sum of \$50,000 is to be expended in a public market.

DETROIT.—Jefferson st, brick office; cost, \$7,000; o, Peninsula Brewing Co.; a, Spier & Rohns; b, A Dorsch.

23d, brick church; cost, \$23,000; o, Pres-on M E Society; a, Mason & Rice; b, P Helson.

Orleans, br shop; cost, \$7,000; o, Detroit Metal Works; a, Donaldson & Meier; b, A Albrecht.

Livernois, br chapel; cost, \$7,000; o and a, All Saints M E Society; b, J J Martin. Dubois, br shop; cost, \$7,000; o, M E Hoffman; a, Scott & Co.; b, H Carew.

NEWPORT, R. I.-About a dozen houses are being built that will cost \$80,000 and

Extensive alterations and additions are being made to houses owned by H H Clark, J P Kernochan, E S Winthrop, and Miss Elizabeth Auchincloss, all of New York.

Masonic Temple is being remodelled at a cost of \$17,000.

H H Clark, of New York, is having five greenhouses built at a cost of \$3,000 each.

LITTLE ROCK, ARK.--Plans are being received for rebuilding the Athletic Club-House recently destroyed by fire; also for a dormitory building for the Arkansas Industrial University, each to cost \$7,500.

PROVIDENCE, R. I.—3 permits for buildings costing less than \$7,000.

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THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

CLUB HOUSE OF THE DOWN TOWN ASSOCIATION OF NEW YORK.

C. C. HAIGHT, ARCHITECT.



THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE REPAVING REQUIREMENTS OF NEW YORK CITY.

On another page will be found a brief report of the preliminary meeting of the Committee appointed by the New York Chamber of Commerce to confer with the authorities of that city to ascertain in what direction they can best co-operate to secure the repavement of its business portion. The disabilities under which the authorities now labor will doubtless be plainly brought out by this public action of the Chamber of Commerce. It is a hopeful sign that this influential body proposes to interest itself in a movement to put an end to the disgraceful condition of the streets of New York, and it is highly important that there should be concerted, intelligent action on the part of all good citizens, except the directors of surface railroads and corporations who are constantly disturbing the streets without any regard to the convenience of the community and the pockets of taxpayers, and who hitherto have never failed to look out for their immediate interests, as has been frequently pointed out in these columns. Four things will have to be decided upon, and until they are done it seems useless to spend any money for new pavements. First.—The present form of street-rail should be abolished, and not another length of it should be permitted to be laid. Second.—Paving of every portion of a street should be done by the city authorities, or under their direction and control. Third.—No openings should be made in the pavements except under permits granted by the Commissioner of Public Works, which permits should state definitely the exact location and limits both of time and space within which the opening can be made. Fourth.—All restorations should be made by the Department of Public Works or under its immediate direction, the cost of which should be paid by the corporation or individual for whom the pavement was originally disturbed. This latter requirement is universal in every city in Europe that pretends to have a pavement worthy of the name. Without it responsibility cannot be placed on any one, nor is it possible to secure by present methods anything but the most worthless and inefficient work. been pointed out in the series of articles on "Pavements and Street Railroads," now appearing in The Engineering and Building RECORD, the custom abroad is to have corporations, like gas or water companies, who have occasion to frequently disturb the streets, leave a regular deposit with the department. Against this deposit charges are made for each piece of paving done at a fixed price per yard, according to the kind of pavement. Where special openings are made special deposits are required. The department in charge of streets, when it issues a permit for an opening, requires the space to be enclosed by means of iron pins and a rope, from which lanterns are suspended at night, and if it is a street which has a concrete foundation under the pavement, time is taken to allow the concrete to properly set be-fore the pavement is relaid. When the necessary authority is given to the proper officials to institute and maintain the reforms here outlined, pavements suited to a civilized community may be secured and retained. To that end it is to be hoped the influence and co-operation of the

Chamber of Commerce may be effectual.

EVERY MAN HIS OWN BRAKEMAN.

THE Revue Industrielle of November 10 describes a new air-brake for railroad trains, recently tested on the Eastern Railway. The idea is to give every passenger a chance to stop the train, and this is done by placing a handle in each compartment, which, when drawn out, puts on the brakes automatically. At the same time two little white disks appear, one on each side of the car, which enables the train-hands to know from what compartment the train was stopped.

This will be a great convenience for passengers who may have dropped something out of the window or wish to get off between stations or to stop awhile to enjoy the view, but as regards the other passengers, who may be in a hurry to get somewhere, it certainly has disadvantages for which even the appearance of "the little white disks" offers no adequate compensation, unless, indeed, they wish to be guided thereby to the compartment of the amateur brakeman and are satisfied "take it out of his hide."

Our Western "knights of the (rail) road" will hail the invention with delight. A convenient confederate in a compartment would relieve them of much trouble in stopping a train, and they in turn could relieve the passengers of many other things.

We believe the suggestion of using the American bell-cord, enabling any passenger to stop the train by signal to the engineer, gave a thrill of horror to English railway authorities, and when at last convinced of the importance of doing something of the kind, they covered the signalling apparatus with a plate of glass surmounted by a recital of divers pains and penalties to be inflicted if broken except in certain prescribed emergencies. The French, in proposing to let any passenger be his own brakeman, seem to have gone to the opposite extreme.

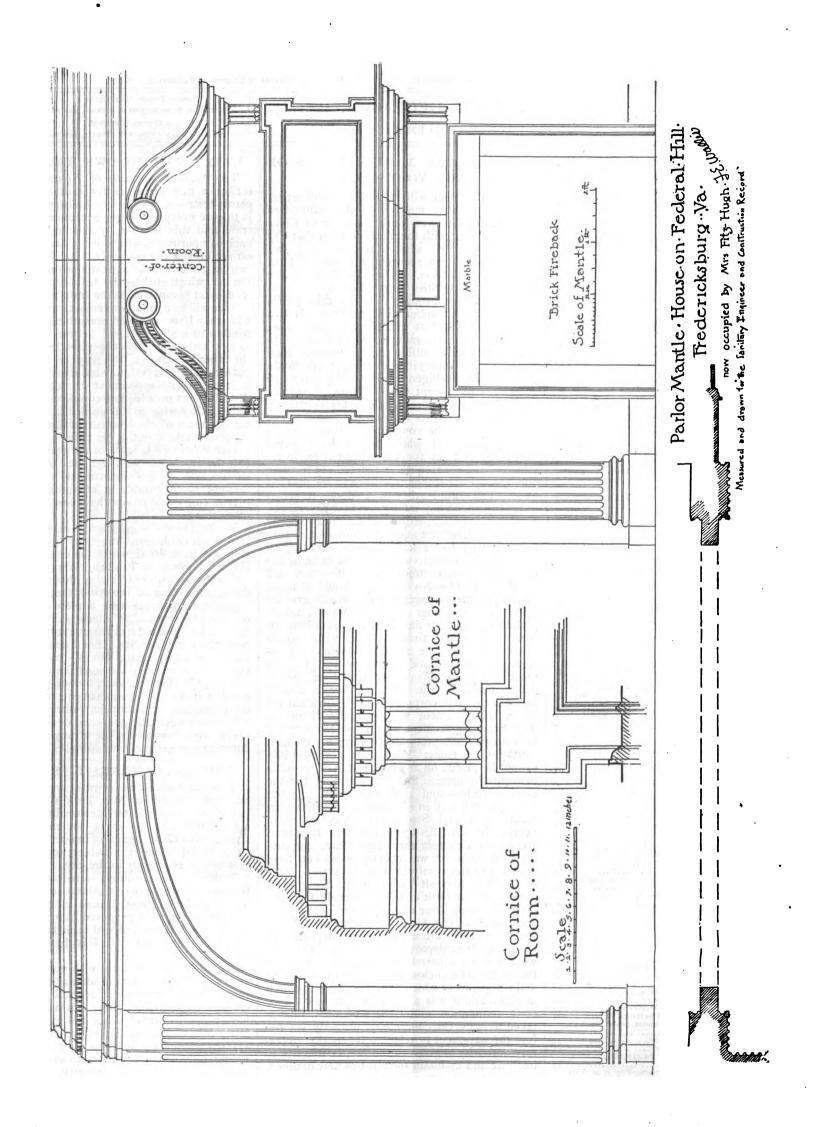
Except in case of assault by one passenger on another in a closed compartment, unhappily not too infrequent on European railways, it is difficult to see when the proposed device would be useful, and, fortunately, the arrangement of our American passenger cars obviates that danger.

THE RAPID TRANSIT PROBLEM.

THE letter which we print in another column on rapid transit in New York City, over the nom de plume of "Inter-Metropolitan," is from a gentleman who has given the matter careful study, and will be found of much interest and value to all whom the subject concerns, and that means everybody in the city.

While we have always advocated viaducts through blocks between streets as by far the better mode of rapid transit in cities, we are glad to welcome the proposed Elm Street tunnel, or any other method of real rapid transit, on the principle that "half a loaf is better than no

We are inclined to agree with our correspondent that a mixed system of alternate viaduct and tunnel might offer great advantages, both in construction and operation; but while he would have it mainly tunnel, using the viaduct only at low places like Canal Street, we would use the viaduct wherever practicable, and resort to tunneling only where necessary to avoid excessive grades or very valuable property, or to connect with some underground system. This suggests the general problem of the best method of connecting with other systems, which must be reserved for more mature consideration.



THE MEDAL COMPETITION FOR A CLOCK-TOWER DESIGN.

THE jury, consisting of Messrs. Richard M. Hunt, Charles F. McKim, Russel Sturgis, John Du Fais, Charles I. Berg, and William C. Hazlett, considered the drawings submitted in competition for the gold and silver medals of the Architectural League on the afternoon of the 12th, all being present.

Forty-four designs were submitted. It was found necessary to throw out one design for non-compliance with the conditions of the problem, leaving forty-three for consideration. The jury proceeded to their choice by a method of elimination, or the "survival of the fittest," and at the conclusion found themselves unanimous for first choice.

The names of the successful competitors will be announced at the reception on the evening of the 17th.

From a cursory examination of the designs it appears that few grasped the exact scope and limitations of the problem, which was a "Memorial Clock and Bell Tower on a Village Green," as a large majority of the designs are of such a monumental and costly character as to be entirely unsuited to the rural surroundings of the site.

All the drawings will be at the exhibition during the three weeks of its continuance.

THE ST. LOUIS WATER-WORKS.

THE St. Louis Globe Democrat has, on December 11, followed its account of the gas-works, which we mentioned in our last issue, by a quite fully illustrated article on the water-works of St. Louis, tracing their growth from the primitive water-carrier, with his two buckets slung from a yoke, to the present arrangement of pumping-engines, stand-pipes, and reservoirs.

If the article should be the means of bringing the good people of St. Louis to a realizing sense of how much it costs to get a good supply of water, and thereby make them more careful to avoid its waste, it will have rendered them a most valuable service and taught a lesson much needed by a majority of the water-users of this country

This lesson will be especially timely at St. Louis just now, as the city has much outgrown its water-supply, and, under pressure of increasing need, the Municipal Assembly last summer, on the recommendation of Mayor Francis, resolved to carry out the plans for a low-service pumpingstation and reservoirs at the Chain of Rocks, as proposed by the late James P. Kirkwood in 1865, and again by Thomas J. Whitman in 1885.

The Globe-Democrat has fallen into a slight error in calling its Grand Avenue stand-pipe the highest on the continent. . The height of the Grand Avenue stand-pipe proper is 160 feet, and its diameter 5 feet, giving a capacity of 23,500 gallons, while the stand-pipe at Sandusky, O., built about ten years ago and described in our columns on the 12th of February last, is 180 feet high and 25 feet in diameter, with a capacity of 661,700 gallons.

FIRE-PROOF CONSTRUCTION IN THE NEW STEVENS INSTITUTE BUILDING.

In the new building of the Stevens Institute for use of the High School it has been decided to adopt what is known as the "slow-burning mill system of construction," which is, in fact, even preferred by some insurance companies to iron construction. It will make the building as nearly fire-proof as it can be made with wood, there being no hollow places in partitions and floors for fire to lurk concealed. The floors will accordingly consist of heavy yellow pine girders placed at intervals of from seven to nine feet apart; on these will be laid a rough flooring of 3-inch tongued and grooved planking; a layer of water-proof sheathing paper is laid over this, and the whole is covered with one inch of lime and sand mortar; over this and on to nailing cleats will be nailed the tongued and grooved yellow-pine floor. This mode of construction, aside from its safety, has the further advantage of giving a deadened floor—a decided merit in a building for such a purpose. The ceildecided merit in a building for such a purpose. The ceilings and girders underneath are plastered close to the wood. The wooden partitions, except those in the classrooms, are to be made of 3-inch tongued and grooved plank, stripped and plastered on both sides, close to the wood. The stairways will be built on the same principle of slow-burning construction. Messrs. Wilson Bros. & Co., architects, of Philadelphia, designed the building, and are superintending its erection. Mr. John Decker, of Philadelphia, is the general contractor. The building will probably be completed before Christmas. OUR ARCHITECTURAL ILLUSTRATIONS.

OLD CHURCH AT BERGEN, NORWAY.

OLD COLONIAL DETAIL SERIES.

PARLOR MANTEL, HOUSE ON FEDERAL HILL. FREDERICKSBURG, VA.

THE NEW YORK CITY HALL.

A WRITER to the New York Evening Post asks:

' Are the authorities aware that there are thousands of people who regard the old City Hall as far and away, without exception, the most architecturally successful and altoout exception, the most architecturally successful and antogether beautiful structure in these whole United States?

"That they may be prevented from altering it or adding to it, except perhaps in height (and that with great discretion), is the anxious hope of many

CITIZENS."

[It is better not to tamper with it.]

NEW PAVEMENTS FOR NEW YORK.

THE committee appointed by the New York Chamber of Commerce to confer with Mayor Hewitt and General Newton as to what steps could be taken in order to best co-operate with the authorities in securing new pavements for the business portion of this city, met by appointment in the Mayor's office on December 9. The committee consisted of Messrs, Francis B. Thurber, Secretary George Wilson, Silas B. Dutcher, James H. Seymour, Thomas Rutter, and Henry C. Meyer. General Newton, Commissioner of Public Works, presented a statement prepared by one of his staff who had made a survey of the down-town streets, which indicated that 536,527 square yards of street surface required repaving at an estimated cost of about two millions of dollars. Mayor Hewitt expressed himself as in favor of authorizing a loan of about five millions to be expended by the Commissioner of Public Works, subject to the approval of the Board of Estimate and Apportionment, for repaving the streets of this city, provided authority were given the Department of Public Works to compel railroad and other corporations to obey its order with regard to the opening of streets and the obstruction of them by needless street rails, put down by railroad companies to hold a charter, but on which they never ran cars. The Mayor cited the aggravated case of the corporation who have rails in Fulton Street. The impossibility of properly doing anything until the authorities had power to control the action of corporations who get grants from the Legislature or Aldermen, and consequently ignored the authorities, was made manifest. A member of the committee urged that all pavements when opened by corporations or other parties should be restored by the department's own servants, the cost of such restoration to be paid by the parties having the streets opened, the amount of space to open at one time, duration of time of such opening, where traffic should be suspended, should also be subject to the discretion of the Commissioner of Public Works. On this point the Mayor said that the Corporation Counsel would be asked to see if further legislation was necessary to give such power to the Commissioner. Pending the securing of the needed legislation suggested, the Commissioner of Public Works proposed to submit a list of the streets that most imperatively needed pavement to the members of the committee, and expressed himself as desirous of expending the \$500,000 appropriated by the Board of Estimate and Apportionment on such streets as the committee should agree most needed it. After assuring the Mayor and the Commissioner that the Chamber of Commerce would heartily co-operate with them in a movement to secure better pavements for this city, the meeting adjourned for further conference when the data promised by General Newton should be prepared.

THE NEW YORK ARCHITECTURAL EXHI-BITION.

THE anticipated interest in the exhibition of the League this year has secured quite an extended notice in a recent issue of the New York Evening Post, the following abstract of which will no doubt interest many of our

readers:

"The projected exhibition of the Architectural League at the Fifth Avenue Galleries has now grown far beyond the original ideas of the association. Hitherto the League has made its exhibition as a sort of side show to the display of the Salmagundi Club, but as the latter resolved not to have any exhibition this year the architects determined to launch out by themselves. Upon inquiring into their resources they were found to be so ample that the League determined to engage the new galleries of Messrs. Ortgies & Co., which can furnish 5,000 square feet of wall-space, and to open their doors to the public from December 19 to January 7. The objects exhibited were

to be architectural designs, perspective drawings, sketches in pen and ink, water-colors, fusain and charcoal, elevations, working drawings, paintings in oil, and aquarelles of architectural subjects, sketches of interior decorations and furniture, designs and cartoons for stained glass and mural decorations, such as mosaics, tiles, etc., and also for decorative stuffs used for hangings; wrought iron and metal work, sculpture, carving, and plaster casts of architectural decorations used in construction. It was found that there would be a splendid display, in particular, of pen-and-ink drawings, for the present system of reproduction by printing from photographs on gelatine films has developed to an extraordinary degree this talent among architects architects.

architects.

"Contributions have been received from the following members: I. Laurence Aspinwall, C. B. Atwood, H. O. Avery, W. A. Bates, Charles I. Berg, W. B. Bigelow, A. Page Brown, A. W. Brunner, Edward H. Clark, Charles W. Clinton, John du Fais, President of the League; John W. Duncan, Charles Edwards, W. Hamilton Gibson, C. A. Gifford, A. D. F. Hamlin, W. C. Hazlett, F. L. V. Hoppin, James D. Hunter, William M. Kendall, Edward H. Kendall, David King, H. P. Kırby, Napoleon Le Brun and his two sons Michael and Pierre, W. P. Little, lames Brown Lord. Charles S. Luce. Henry Rutvers Brun and his two sons Michael and Pierre, W. P. Little, James Brown Lord, Charles S. Luce, Henry Rutgers Marshall, Charles T. Mott, Arthur Pickering, Bruce Price, C. A. Rich, John P. Riley, R. H. Robertson, John Beverley Robinson, E. K. Rossiter, William H. Russell, A. C. Schweinfurth, Edward P. Sperry, A. H. Thorp, Prentice Treadwell, Thomas Tryon, Frank Waller, Frank E. Wallis, Edward M. Welch, Stanford White, F. G. Willey D. W. Willard Frederick C. Withers F. A. Wiley, D. W. Willard, Frederick C. Withers, F. A.

Among the contributions will be the drawings for the Among the contributions will be the drawings for the great hotel called the Ponce de Leon, in St. Augustine, Fla., by Carriere & Hastings. Also there will be a series of large pen-and-ink drawings by Pennell of the Cathedrals of England, which will be studied with great interest. There will be also forty drawings made by draughtsmen under twenty-five years of a memorial clock and bell-tower on some village green, and the first placed will receive a on some village green, and the first placed will receive a valuable gold medal, the second a silver medal. Three hundred dollars have been set aside by the League for this purpose, and it is under contemplation to make the com-petition an annual one for the purpose of encouraging

good design and good rendering.

"Besides this exhibition there will be a loan collection of all the objects of applied art which are connected with architecture, and also of decorative objects tending to illustrate the artistic methods of using ornamental creations so as to obtain harmony of effect. The committee for this so as to obtain harmony of effect. The committee for this purpose is composed of H. O. Avery, Frederick Crowninshield, E. H. Blashfield, and John Gellatley. This committee has worked like so many beavers, and has obtained a wonderful collection of decorative stuffs, sculpture, tapestries, Venetian embossed leather, objects in ormulu, and in buhl work, Italian ivory marqueterie, enamels, carved wood, bassi-relievi, pictures, inlaid furniture, etc. Marcotte, Herter, and Cottier have seconded its efforts with the greatest zeal.

The committee has been enabled to borrow from the estate of the late Edward Mathews the twelve panels of the famous Galand, illustrating the months, which that famous connoisseur purchased from the Paris Exposition in 1867. Galand is the decorator who was employed to in 1867. Galand is the decorator who was employed to paint the panels of the large halls in the palace of the Czar at St. Petersburg, called the Winter Palace. This exhibition will also show splendid panel-work by American artists, Blashfield, F. S. Church, Shirlaw, Beckwith, Dewing, and John La Farge. The work of these gentlemen is to illustrate the manner in which painting must be modified when used for decorative purposes.

"A new form of tapestry-hanging will be introduced to

when used for decorative purposes.

"A new form of tapestry-hanging will be introduced to the American public. It is a stuff woven in such a manner that it can be painted on, and the pigments are dye colors, and as soon as applied sink in and become imperishable. Two specimens will be shown painted in the material by Galand, the subjects being 'Night and Morning,' replicas of two panels which he painted in the Winter Palace Morning,' repl Winter Palace.

"When it became evident that all the art world connected with architecture and internal decoration was enthusiastic over the exhibition, the idea was started that it would be a fitting opportunity to show some marked token of respect to Richard M. Hunt, who has been newly elected President of the American Institute of Architects, and who, during the current year, has received the cross of Chevalier of the Legion of Honor, and has been elected corresponding member of the French Insti-tute. It was therefore agreed that a reception should be held on Saturday, December the 17th, prior to the public opening on the following Monday."

THE TEXAS CAPITOL DOME SAFE.

A SPECIAL dispatch to the Chicago Tribune of December 10 states that the three expert architects-Harrod, of New Orleans, Clayton, of Galveston, and Heiner, of Houston-appointed by Governor Ross to examine the new State Capitol at Austin, Tex., now nearly completed, after a thorough examination report the great dome safe.

It will be remembered that there have recently been rumors affecting the stability of the dome, which, it is to be hoped, this report will set at rest-

BUILDING CONSTRUCTION DETAILS. No. IX.

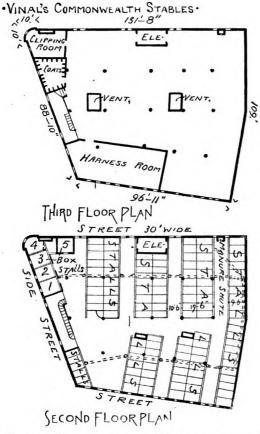
(Continued from Vol. XVI., page 678.) STABLE-FLOOR CONSTRUCTION.* Vinal's Commonwealth Stables.

THESE stables, which are just being finished for Mr. Warren D. Vinal to replace those bought by the Cab Company, are located on the opposite side of the B. & A. R. R., on two new streets just off of the new bridge being erected over the railroad on Boylston Street, Boston.

The structure is of brick, three floors and basement; covers about 11,000 square feet, and will cost about five dollars a foot. The floors are all 12 feet in the clear. All are supported on wood or iron columns, giving a clear space over the whole area.

The basement is to be used for storing carriages and has six inches of concrete; here is also located the engine and boilers for heating the building and supplying hot water, and the motive power for carriage-elevator and the clipping machines; also a manure-pit, some 10x20 feet, all bricked up and only accessible from outside.

The first or ground floor contains the offices, parlors, and waiting rooms and arrangements for storing and washing carriages.



The second floor contains stalls for about 120 horses. The third floor, originally intended for carriages, is about to be fitted up with about 90 stalls. Here is also a large harness-room, clothes-room for drivers, etc., and a clipping-room to contain four power clipping-machines. The fourth floor is for storage of carriages and sleighs.

A large elevator, some 9x18 feet, will run from basement to upper floors.

The second floor, the only one originally designed for stalls, is laid out with sloping floors. The floor is supported on three lines of 15x5-inch iron I-beams on 10-inch iron columns. On top of the I-beams tapering pieces of hard pine are placed under the stalls, having a thickness varying from nothing to $3\frac{1}{2}$ inches. The floor-joists, 3x14-inch, are set on these and covered with 1-inch matched boards. In this way the floor under the stalls is laid sloping, the lines of stalls being head to head, with a 10-foot 6-inch passageway between them, having a wooden gutter on each side. It is on top of this boarding that the Dolbear patent stable-floor is laid.

A sheet of English sheathing-felt is first laid over the whole floor, on which strips of white pine $2\frac{1}{2}$ x5 $\frac{1}{4}$ -inch are laid with $\frac{5}{16}$ -inch joints all around. The spacing is regulated by wooden wedges which are left in till the floor is double-nailed on each joist.

The 2½x5¼ pine strips are planed all over, and on the bottom both edges are rabbeted about ½-inch to give

* For previous articles on this subject see page 431, Vol. XVI.

the pitch a better hold. After being nailed firmly a hot mixture of pitch and pine tar is poured into the joints. In the passageways where the floor is level the joints are filled at a single pouring; but where the floor is inclined the pitch is poured at four different times. When all the joints are full the same hot mixture is spread in a thin coat over the whole floor.

The floor is thus rendered water-tight; the pitch sticks to the wood, and if it shrinks the pitch stretches and does not part from it as asphalt does. Oakum calked in makes a tight floor, but the urine destroys it.

This flooring costs about twenty-three cents per square foot. A spruce floor is laid above this, which can be easily renewed. In the stalls 2-inch spruce planks are laid crosswise for three feet at the head; for the rest of the way tapering planks from four to six inches wide are laid with one inch open joints. These planks are two inches at the upper end and 3½ inches thick at the foot, so that the horse stands on a level floor in his stall. Some hard-wood strips one inch square are placed in the bottom of the spaces between the plank; in this way the cleaning hooks do not strike into the pitch coating when cleaning out the drainage grooves.

In the Vinal Stables the stalls are 9 feet deep and from 4 to 5 feet wide. The sides and front are of 1¾-inch tongued and grooved hard pine, which runs up 7 feet on the front. At the sides are sloping wire screens, so the planking extends only 5 feet above the floor. Instead of

PAVEMENTS AND STREET RAILROADS.
No. XXII.

(Continued from page 22.)

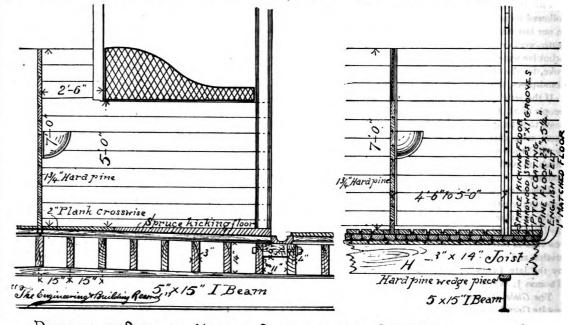
NOTES ON KING'S ROAD WOOD PAVEMENT.

[Prepared for The Engineering and Building Record by George E. Strachan, A. M. I. C. E., Surveyor of Parish of Chelsea.]

These works were executed as relief works in the early spring of 1886, and done without intervention of a contractor. The site is between Limerston Street and Stanley Bridge; the area paved being 6,666 square yards.

The road was previously covered with macadam consisting of Guernsey granite. It was excavated by means of steel wedges driven through the crust by sleuge-hammers. Then, when an opening was made, wedges were driven under the crust, and it was lifted by levers in pieces twenty feet square. These were broken to pieces by hammers, and screened through an inch sieve and then through a ½-inch sieve; 1,440 cubic yards were carted to the wharves for use on macadam roads, and the remainder (about 2,000 yards) was waste. The Lottom of the excavation was shaped so as to give the curve of road (see Vol. XVI., No. 12).

The surface thus prepared was covered with six inches of concrete, consisting of 5½ parts of Thames ballast to one part of carefully tested Portland cement. On this was placed ½ inch of fine concrete, three parts Thames sand to one of cement, laid and floated to a perfectly smooth



· DETAILS OF STALLS · VINALS COMMONWEALTH STABLES ·

solid posts secured to the floor-joists at the foot of the stall partitions, the post is formed of two 1¾-inch hard pine planks 8 inches wide set either side of partition, so that when either side is destroyed by kicking horses it can be easily replaced.

Two ventilating-shafts, 7xII feet, run to skylights in the roof from the ceiling of the second floor, with movable sashes in third floor for its ventilation through the same shafts.

A brick flue runs up from manure-pit, with iron door on the second and third floors for throwing manure into pit.

On the fourth floor a large chamber is partitioned off for storage of grain and hay, with door and tackle for hoisting the bales.

Two lines of 4-inch soil-pipes take the drippings from the middle of each gutter. These unite on the first floor, and in the basement all the soil-pipes empty into a 6-inch pipe.

pipe.

The plans were made by Alonzo S. Drisko, contractor and builder.

THE FIRST RACK RAILROAD IN FRANCE.

On the 6th of November the first rack railroad in France was opened to the public at Langres. We learn from Annales Industrielles that this city is located like an eagle's nest at an altitude of 1,550 feet, and the nearest railroad stations are several miles from the town. The municipal authorities have sought to remedy this state of affairs for a number of years, as the development of the city was seriously retarded. A number of plans were proposed, but preference was given to the rack and pinion system on a narrow gauge, to run from the Langres station at Marne to the centre of the city. The rack-rail system is the same as that at Righi, in Switzerland. The rounds of the rack are spaced .10 metre from centre to centre, and bolt through the sides, which are formed of pieces bolted to the ties. The rails are of steel, and the locomotive has a toothed wheel which engages the rounds of the rack.

surface. The method of laying was as follows: At gulleys (or catch-basins), which are 6½ inches below the curb, the centre of the road was made at such a height that ½ inch to the foot fall was given in the cross section. The channels (or gutters) had a fall of one in 150. The centre line of the crown of the road was made level, thus giving a fall in the cross section of ¼ inch to the foot at the summits of the channels. A narrow strip of concrete was placed in each channel and strips of wood laid on them and nailed to pegs at the exact grade. The crown of road had a similar strip of concrete and screeds also nailed. The templates were very accurately made to the curve of road, faced with iron, and when drawn along longitudinally by resting on the screeds they molded the fine concrete into a perfect curve.

The concrete was allowed to dry for seven days.

The blocks were yellow deal, 9x5x3 inches. Great care was exercised in rejecting bad blocks. The method used was as follows: An intelligent wood-pavior receives the blocks and rejects those which he is satisfied are bad, dividing those he passes into two lots: (a) Those that are without flaw or defect : (b) those which have only slight defect. Blocks rejected by him are not examined again. The lot (b) are examined by the clerk of works, who rejects such as he pleases, and sorts those passed into (c) those he considers fit, and (d) those which are doubtful. The lot (d) are examined by the surveyor, and the good ones passed. The paviors have instructions to throw out any defective blocks which have escaped, and after the blocks are laid, but before they are grouted, they are again looked over. Even then bad blocks get in. A fine of 10s. a 1,000 for rejected blocks is enforced. At first the con tractor has about 30 per cent. of his blocks rejected, but

he soon learns to sort over the blocks before sending them. On this work five per cent. of the blocks delivered were rejected (I in 20).

The blocks are separated by iron studs, as described in previous articles. They are laid with their lengths at right angles to the traffic, and the studs give a joint transversely of three-eighths of an inch.

The blocks are placed on the concrete, and the spaces at the joints filled in with cement grout (composed of 3 sand to 1 cement). Seven days are allowed for drying. The surface is then covered with very fine pebbles to a thickness of a quarter of an inch, and the traffic is turned on. The pebbles are crushed and the pieces are driven into the surface.

One inch in ten feet is allowed next the curbs for expansion.

The actual cost was-

	Total.		Per square yard.
	£. s.	ď.	s.
Labor	1,011 7		3.03
Blocks	1,185 17		3 55
Cement	406 3	5	1.21
Cartage	266 18	2	.80
Ballast, sand, and pebbles	251 14	5	-75
Use and repair of tools	108 9	Q	. 32
Studs	34 13	6	.14
Incidental expenses	24 15	1	.07
Totals	£3.284 18	10	9.87

As to Life of Wood Pavements.—Eight years under traffics of 500 tons per yard in width every sixteen hours. (Blocks not creosoted.)

First three years no cost for maintenance. Next five average cost of 2d. per square yard.

The wood gets bumpy towards the seventh year.

Scavenging wood pavements costs in King's Road onesixteenth of what macadam does.

After washing and after rain wood pavements have a perceptible, but not unpleasant, odor.

Wood is practically noiseless.

Creosoting adds to the life of wood, but its cost is 1s. 6d. per square yard in addition to prices given. For streets with traffic weights under 500 tons per yard width in sixteen hours it does not pay, as creosoted and plain woods become bumpy after a certain wear, so that additional life is then an annoyance.

Hard woods are not good for wood pavements. The surface gets bumpy sooner than with soft woods.

Cement joints are water-tight and wear well.

Openings by water and gas companies are repaired by the Vestry. The excavation is rammed and watered, the concrete is carefully restored, and the contour preserved. The concrete is then allowed to dry; then the space is repaved, and not until the grout is dried is the traffic allowed over it. The actual costs incurred are refunded by the companies for whom the work is done.

THE STRENGTH OF IRON AS AFFECTED BY TENSILE STRESS WHILE HOT.

WE take the following abstract of a paper, recently read by Professor De Volson Wood before the American Association for the Advancement of Science, from the Stevens Indicator of October 15, believing that as we have recently given our readers some articles on the effect of cold upon structural iron and steel, they may be interested to learn the effect of the opposite extreme of temperature:

"In the course of my instruction I was asked how the strength of iron was affected by subjecting it to a tensile stress while hot. The question arose from the fact that a train of oil burned while standing on an iron bridge at New Brunswick, N. J. To determine the effect, I had twelve specimens of good iron prepared for the testing-machine by making the middle portion for about five inches cylindrical, and 0.770 inch in diameter. Two of these were broken cold, to determine the strength in its normal condition, the mean value of which was 50,500 pounds per square inch. Six of the others were heated in a forge to a dull red heat and at once subjected to a pull of 4,200 pounds, being one-fifth the strength indicated by the first two specimens, and the stress remained uniform for fifteen minutes, after which they were removed from the machine and allowed to cool, some in water and others in air. It is not apparent that the manner of cooling made any difference in the ultimate strength. The six pièces gave the following results:

 Maximum strength
 51,330 lbs. per sq. inch.

 Minimum
 47,720

 Mean of the six specimens
 49,765

"Four specimens were heated in a similar manner, though some of them were made somewhat hotter, and subjected to a stress of 5,700 pounds for fifteen minutes, being about one quarter the strength indicated by the two

first specimens; they were afterwards broken cold, with the following results:

 Maximum
 57,150 lbs. per sq. inch.

 Minimum
 48,290
 "

 Mean of the four
 50,026
 "

"The mean results indicate that there is a slight diminution of strength by stretching iron while hot, but if the stress does not exceed one-quarter of the ultimate strength, the loss of strength is scarcely more than one and a half per cent. The experiments indicate that unless there be a perceptible elongation while hot, the specimen is not weakened by the treatment. Thus one specimen elongated 0.23 of an inch for a length of five inches under a stress of 5.700 pounds, another 0.28 of an inch for the same length under a stress of 4,200 pounds, and still another 0.32 of an inch for the same length and stress as the former ones; and these were the only specimens that broke at less than 50,000 pounds per square inch. It is probable that these were hotter than the others when the stress was applied, as the eye was the only guide for determining the degree of heat."

REPORT OF THE WATER BOARD OF NEW-TON, MASS.

THIS report, though not bulky, contains some very valuable information.

By the suggestion of the City Engineer, Mr. Albert F. Noyes, a series of twelve tests were made to determine the bursting pressure of 6 and 8 inch cast-iron pipe. The thickness of the 6-inch varied from 0.53 to 0.56 of an inch, and the bursting strain was from 1,657 to 2,063 pounds per square inch. The 8-inch pipe were from 0.575 to 0.625 of a inch thick, and they burst at from 1,868 to 2,144 pounds. Of course, water-pipes have to bear other strains as well, but in good ground it would seem that there was no need of so great an excess of strength.

The dimensions of pipe in use are based on the "Shedd" formula.

Mr. Noyes also reports on tests of eight driven weils for increased water supply. A 30-days' pumping-test in a dry time gave a yield on the last day of 283,000 gallons, on which quantity the amount paid for the work was based for 24 hours' pumping as measured by a 4-inch "Gem" meter. The water was found in a coarse gravel and had a temperature of 50° Fah.

By pumping nine hours a day the yield apparently for 24 hours would have been from 309,000 to 335,000 gallons, reducing the water-level in the test-tubes about 16 to 19 feet. In the 30-day test the level was reduced as low as possible, or 22 to 23 feet. The water would rise in the tubes after pumping was stopped, at the rate of 12 to 14 feet in 30 minutes, and recover full depth before the next day.

The average daily consumption for the year was 675,298 gallons, ranging between 220,915 and 1,999,537 gallons, the population being in 1885, 19,759.

Meters are being introduced rapidly, 1,591 of all classes being now in use. There were 22,164 feet of new pipe laid during the year.

The cost of pumping a million gallons $216\frac{8}{100}$ feet was \$19.62, and per foot of dynamic head it was 9 cents. The cost of pumping figured on *total maintenance* was for the year \$271.75 per million gallons pumped, and \$1.25 for each foot of dynamic head it was raised.

THE MONTREAL WATER-WORKS.

THE report of these works for last year made by the Superintendent, Mr. Louis Lesage, is very full and complete. In the appendix are reports from Mr. B. D. McConnell, Assistant Superintendent, D. Kearney, Engineer of pumping-works, and Charles Lagace, foreman of distribution.

The present population of the city is 192,500.

The water is taken from the St. Lawrence River through five miles of open aqueduct, pumped into reservoirs and distributed through 23,553 feet of 30-inch pipe, 39,303 feet of 24-inch, 2,694 feet of 16-inch, 45,647 feet of 12-inch, 77,156 feet of 10-inch, 6,853 feet of 8-inch, 206,091 feet of 6-inch, 347,622 feet of 4-inch, and about 14,000 feet of smaller sizes. There are 13 30-inch valves, 32 of 24-inch, 4 of 16-inch, 63 of 12-inch, 91 of 10-inch, 28 of 8-inch, 301 of 6 inch, 625 of 4-inch, 38 of 3-inch, and 945 hydrants. Number of houses supplied, 29,981, the increase for the year being 1,326, and the increase in pipe laid 34,886 feet.

The daily average of water pumped was 12,643,000 gallons, an increase of 672,500 gallons over that of the previous year. The average to each inhabitant was 65.5 gallons, and to each consumer 65.8.

Of the 4,614,679,000 gallons pumped 3,873,647,000 was pumped by water-power (three turbine-wheels and one breast-wheel), at a cost for pumping-station expenses of \$1.61.9 per million gallons raised against a dynamic head of 194 feet, or of .83 per feet of dynamic head; 741,033,000 gallons pumped by steam (one Gilbert engine of 3,000,000 gallons capacity, and one Worthington of 8,000,000) for the low-level service, the cost per million gallons pumped against 173 feet dynamic head was \$23.38.8, or against one foot of head, .13.52, cents. For the high-level service, supplied by a Worthington engine of a half-million capacity, the cost for 230 feet dynamic head was \$53.32.2, or per foot 23.18 cents.

The cost per million gallons raised, figured on *Total Maintenance* of \$378,900 for the year, was \$82.11. Of this cost, \$207,214 was for interest on cost of works, and \$81,686 for maintenance. The expense of central office and salaries was \$11,287. The average cost for raising one million gallons against one foot of static head was .0127 of a cent by water, and .143 of a cent by steam. The average for the high level was .283 of a cent.

Of the total quantity consumed, about 9 per cent. was metered, furnishing a revenue of 16% cents per 1,000 gallons, or 1½ times that furnished on a rental basis. This difference will be increased when some arrearages are paid up. There are in all 549 meters in use, 86 having been placed and the use of 49 discontinued during the year; 20 were damaged by frost, and 7 totally destroyed.

The total income for the year was \$521,628.

Considerable repairs were made necessary by the heavy floods; and the water-wheels having been in use some thirty years must soon be renewed. The distribution in the central part of the city has been improved by new mains, giving a greatly improved pressure for fire purposes.

A system of house inspection has been instituted, and although not yet completed, 2,621 cases of defective fittings have been discovered, the average waste from each per hour being 11 gallons. Aside from this, 35 taps left open to prevent freezing wasted 16 gallons per hour, 44 taps to flush drains wasted 38 gallons per hour, and over 200 cases of illegal use of water were found.

The ground is frozen in the winter often to a depth of eight feet, and the number of times hydrants were frozen was two thousand five hundred and sixteen. It is found that hydrants nearer than six feet to a catch-basin or an open area are frozen much oftener than any others.

The thawing is done by two portable steam-boilers.

CAR-HEATING NOT FROM LOCOMOTIVE.

A "SAFETY" car-stove was tested in Chicago the other day, first by being thrown while red hot a distance of 128 feet to the ground, and then by being placed in a freight car which was smashed by an improvised collision. The first experiment was successful, the latter was not, for the car was incontinently consumed, and though the stove hardly had a fair chance, being surrounded by shavings saturated with turpentine, we feel confirmed in our longcherished conviction that the only safe place for the "safest" car stove is in the station or freight house; unless, indeed, the conductor is always as thoughtful as one on a Southern railroad where, to an old lady's complaint that the fire had gone out, the brakeman explained: Yes, ma'am. You see we're goin' to strike a stretch of poor track, and as the train's an hour late, the conductor allowed we'd better let the fires go out."

A CHART OF WIRE GAUGES.

WE have received from the Electrical World a copy, engraved and published by that journal, of the "Chart of Wire Gauges," described by S. S. Wheeler, Jun. Am. Soc. C. E., in a paper read by him before the American Society of Civil Engineers, of which an abstract was given in our issue of the 26th of November last. All the important and typical gauges, not only for wire, but for plates, screws, drills, etc., as well, are shown graphically. Each gauge is represented by a line whose vertical ordinates correspond to the gauge numbers and the horizontal ordinates to the diameters or thicknesses in thousandths of an inch. This shows at a glance the distinguishing features of each gauge and affords a very ready means of comparison, which will be appreciated by all who have occasion to specify the thickness of plates or wires by gauge numbers, which often seem inextricably confused.

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TO ELEVATE THE TRACKS IN PITTSBURG.

THE special Committee on Grades and Crossings of the Engineers' Society of Western Pennsylvania held a meeting in Pittsburg on the 5th inst. to discuss and formulate a plan by which all railroads crossing important thorough fares in Pittsburg and Allegheny City can be put on elevated tracks The sentiment of the meeting was favorable to its feasibility.

WEDDED TO HIS PROFESSION.

A PARAGRAPH has been going the rounds of the press of late purporting to be a truthful account of a remarkable case of absent-mindedness which made a young man forget his wedding day. Apropos of which a prominent civil engineer told the following story to a reporter of the Chicago Tribune:

'I know of a much more remarkable case. absent-mindedness, however, but an illustration of the wonderful concentration of thought which is possible in reat emergencies. Somewhere about 1857, Ed. D. Iason, Assistant Engineer on the Wabash Road, went to Buffalo to be married. The ceremony was performed at 10 o'clock in the morning. While congratulations were being extended the newly-wedded Benedict received a telegram from his chief in Toledo informing him that an important truss-bridge over a river on the line of the road had been burned and must be rebuilt immediately. The working plans could not be found, and Mason was ordered home. As the trains ran he could not reach Toledo behome. As the trains ran he could not reach Toledo before the next morning. Taking a hasty adieu of the bride and the wedding party, and promising to return at 3 o'clock to partake of the wedding dinner, he hurried to the office of an engineer well known to him, who at once placed the facilities of his office at Mason's disposal. By 11 o'clock he was hard at work. When 3 o'clock came, feeling faint and weary, he walked down stairs mechanically, entered a neighboring restaurant that he had frequented before, refreshed himself with a sandwich and a glass of beer and returned to his work. By 5 o'clock he had duplibeer, and returned to his work. By 5 o'clock he had dupli-cated the original plans of the bridge from memory, including exact measurements and quantities, and tele-graphed them to Toledo. On this telegraphic plan the bridge builders instantly set to work and found it absolutely correct even to the minutest detail. It was a most astonishing feat. But what is still more astonishing is the fact that from the moment Mason left his bride in the morning until he had forwarded his telegraphic report he never recalled the event of his marriage. When he went never recalled the event of his marriage. When he we out for his lunch he might just as well have gone to wedding-dinner, as the distance was no greater, and excused himself without loss of time. But his mind was so intensely occupied in meeting the emergency that no thought of anything but the burned bridge could gain entrance. In later years Mason was a colonel in the army, entrance. In later years Mason was a colonel in the army, a prominent member of the American Society of Civil Engineers, and left as monuments to his skill the bridge over the Mississippi at Hannibal and that over the Missouri at St. Joseph. He died some thirteen years ago. His widow is still living, and has in my presence corroborated, in so far as she could, Colonel Mason's account of his wedding-day experience."

THE Austrian Hydrographic office publishes a new method for copying drawings. According to the Mittheilungen aus dem Gebiete des Seewesens, the paper upon which the copy is to be made is laid upon the original drawing and lightly rubbed with raw cotton soaked in pure benzine. The benzine is absorbed into the paper and renders it as transparent as the best tracing paper The finest drawings may be copied by pencil, pen, brush, or water-color, and there will be no tendency for the colors or the ink to run. The paper does not shrink or curl. The marks made by the pencil, pen or brush are much more difficult to erase. With large drawings portions may be copied at a time, and, whenever necessary. the benzine may be applied over again. When the copy is finished the paper is simply left to dry. The benzine will evaporate and leave no stain, while the paper will become as white and opaque as before and leave no odor of the benzine. Pure, clean benzine must be used.

[We have had good blue prints made from drawings on very thick paper which had been made temporarily transparent in the same way by saturating with benzine.--ED.]

THE Chronique Industriclle of November 6 contains a curious case in which the magnetic needle plays an important role. The daughter of a Mr. Preece accidentally stuck a needle into her hand which broke into three parts. Two of these parts were easily found and extracted, but the third could not be located. The Hughes' induction balance plainly indicated that the piece of needle was there, but not its position. Mr. Preece highly magnetized a fine needle and suspended it by a single fibre of silk. The deviations of the suspended needle always plainly indicated one particular spot when the sore hand approached it. After a number of trials with the same result, this point was marked, an incision made, and the third piece of the broken needle four millimetres long was found and easily extracted. THE Chronique Industrielle of November 6 contains a extracted.

SNOW AS A CONCENTRATOR OF ACID VAPORS.

UHLAND'S Industrielle Rundschau gives an abstract of a paper by R. Sendtner, published in the Meteorologischen Zeitung, explaining the injurious effect of snow on works of art. The author states that works of art deteriorate by climatic influences more rapidly in cities than in the country, and that the injurious effect has been much greater during the last forty or fifty years than formerly. The injury is mainly due to the presence of large quantities of sulphurous and sulphuric acids in the atmosphere of cities since coal has been used in dwellings and factories. These acids are absorbed by the moisture on exposed works of art, and the effect is that of a bath in dilute sulphuric acid. Mr. Sendtner shows that snow has a peculiar power for absorbing these acids. Fresh snow at Munich and at Forstenreid, five miles from Munich, was examined and found to contain seven to eight milligrams of sulphuric acid per kilogram of snow (or about six-hundreths of a grain to one pound of snow). Fourteen days after this snow had fallen it was again analyzed, and that at Munich was found to contain sixty-one milligrams of sulphuric acid per kilogram of snow, while that at Forstenreid had not absorbed any additional amount. City snow must therefore be especially injurious to statuary, works of art, etc. No remedy is suggested, except that which is self-evident, to box the statues which may be exposed.

[This danger should be borne in mind by architects and sculptors in Northern cities, and their work so designed as to afford as little lodgment for the snow as possible. Paraffine or soluble glass would perhaps give efficient protection, and shellac varnish also resists dilute acids. Fortunately the parts most exposed to the action of the acids absorbed by snow are usually least exposed to view. and hence discoloration either by corrosion or the use of a protective will be less injurious.

We should be glad to hear from those who may have had experience in this matter in some of our specially smoky cities, such as Pittsburg used to be, either as to the effects of corrosion or the efficiency of protectives. _Ep.1

La Lumière Électrique states that the French threadworks of Oudin et Cie at Dinant, which have used 36 electric arc lamps during the past year, have discarded the use of gas entirely. A comparison of the cost of gas and electricity at these works is made as follows:

COST OF GAS FOR ONE YEAR.

Three hundred and sixty burners of 123 litres at 0.18 francs per oic metre [about \$1 per 1,000 feet—ED.]; cost per hour 7.97 francs. Eight hundred and fifty-seven hours at 7.97f 6,820.30f.

Carbons for 857 hours for 36 lamps at	7,420.30f.
0.044 f 1,357.50	
Interest, etc., on plant 1,800.00	ı
Care and maintenance 350.00	•
Coal for 857 hours 254-50	1
Additional coal for defective boilers itc.oo	ı
	•
Total 3,872.cc	3 872.00
Net saving by use of electricity	3.547.30%

SEWER VENTILATION DIFFICULTIES.

MR. JOSEPH GORDON, M. Inst. C. E., the Borough Engineer of Leicester and President of the Association of Municipal and Sanitary Engineers, in his annual address reviewing the progress of sanitary engineering, thus referred to the difficulties attending attempts at sewer ventilation. His report of the attempt to utilize factory chimneys to receive sewer-air is similar to that made by all who have tried it-namely, that it is of little use except in sections in the immediate vicinity of the chimneys. It must be borne in mind, however, that in the older cities of England and the continent the problem is a more difficult one because of the narrowness of the streets. In that respect the cities of the United States are more favored. and the complaints against manhole ventilation are seldom heard, which system is the one adopted and best suited to the conditions generally existing in this country. Mr. Gordon savs:

"Sewer ventilation seems unsolved, and I would earnestly entreat members, all of whom have, more or less, opportunities of experimenting and making observations of the behavior of sewer-gas under certain conditions, to direct their attention to this subject. It is admitted on all hands that the sewers must be ventilated—that is, that

there must be a means of escape for the polluted air of the sewers, for it is well known that the conditions prevailing within the sewers during the twenty-four hours of the day are very varying, and on this subject the early observations of the late Medical Officer for the city of London (Dr. Letheby), and the present Engineer for the city of London (Lieutenant-Colonel Haywood), and the still more recent investigations of Professor Pettenkofer, of Munich, Proinvestigations of Professor Pettenkofer, of Munich, Professor Soyka, of Prague, and our own members, Mr. McKie, of Carlisle, Mr. Read, of Gloucester, and others, are well worthy of attention. It does not, however, seem to be so readily or universally conceded that a plentiful supply of fresh air is of equal importance, and that the great aim and object of sewer ventilation should be the introduction of atmospheric air for the purpose of diluting and oxidizing the air of the sewers, and the creation of a current to some exit, which shall, if possible, either be above the roofs of the houses, or still better, to some point where the sewer-gas can be cremated. The most recent contribution to this subject, in direct opposition to these views, is to be found in the address of Professor Attfield to the Hertfordshire Natural History Society and Field Club, in which it is laid down that all that is necessary is vent at an elevation above the ground, and that, therefore, the surface ventilators or other openings for the introducthe surface ventilators or other openings for the introduc-tion of fresh air are not only not necessary, but are, on the

contrary, injurious, even when acting as down-cast shafts.
"These aims and objects are beset with difficulties, and
the most scientific minds of the country have failed so far to devise a method of ventilation, which shall at the same time be within the range of practical application as regards

time be within the range of practical arcost, and universally satisfactory.

"The report of last year of a Committee of the Metropolitan Board of Works is worth attention, as showing the metropolitan surveyors. Out of the forty opinion of the metropolitan surveyors. Out of the forty districts the opinions of whose surveyors were taken, thirtythe were in favor of open ventilation, two were doubtful, two against, and one had no experience in this matter. The average distances of the ventilators were from 30 to 200 yards, and the committee came to the conclusion 'that pipe ventilators of large section can be used with great advantage in addition to, and not in substitution for, surface ventilators.

"To supplement the street openings as much as possible with vertical cast-iron or other shafts up the house sides would seem to be the first thing to do, for there can be no doubt the more this is done the more perfect will be the ventilation of the sewers. It must also not be forgotten that the anxiety of late years of English sanitarians to protect each house from the possible dangers of sewer-gas from the street sewer has led to a system of so-called disconnection of the house-drains by a water-seal or syphon-trap, and that consequently the soil-pipes of the houses, which, when carried through the roofs, acted as ventilators to the public sewers, have been lost for this purpose, and thus the difficuity of sewer ventilation has been greatly To supplement the street openings as much as possible the difficulty of sewer ventilation has been greatly

In Leicester we have been fortunate enough to secure the co-operation of factory owners, who have allowed us to connect no fewer than fifty-two chimneys, while we have already carried out, at a cost of about \$1,250, 146 special shafts up the house sides, with a locked opening upon a large number of them, by means of which we can test the velocity of the current as well as the temperature of the outflowing air. The connections with the high factory chimneys are all of too small a calibre to be of great use, being generally only six inches, with a few exceptions of

being generally only six inches, with a lew exceptions of ninc inches in diameter.

"The radius of effect of specially-erected chimneys, as shown by the experiments of Sir Joseph Bazalgette, and as experienced with the special ventilating towers erected at Frankfort, is disappointing and discouraging when the cost is taken into consideration. It cannot be expected, however, that manufacturers will admit larger connections to be made with their chimneys otherwise of course much ever, that manufacturers will admit larger connections to be made with their chimneys, otherwise, of course, much more satisfactory results would be obtained. To fall back upon special shafts up the house sides means, in my opinion, that there should be probably as many in number as are represented by the soil-pipes of the houses, for in this we have a tested example at Frankfort, which, so far as I know, has up to the present moment proved eminently satisfactory. The distance apart of such shafts would largely depend on the size of them, but as a rule it will be found house owners object to large pipes, in which case the found house owners object to large pipes, in which case the number must be increased, and if we take a distance of about thirty yards, we should require about 5,000 such shafts in Leicester.
"Whether some artificial means of inducing currents in

sewers by drawing down fresh air from shafts above the eaves of the houses, and sending forth the diluted sewergas to still higher levels, or burning it in an outcast shaft, will take the place of natural ventilation, and prove to be less costly and more certain in its action, remains to be seen; but it is quite certain that notwithstanding the patents which have already been taken out and failed, and those now before the public, there is still a wide field of re-search before this question is satisfactorily solved so that no cause whatever shall remain of complaint on the part of

THE NEW MILWAUKEE DRY DOCK.

THE WEATHER HEW MILEWACKEE DAY DOCK.

THE weather for the past three months has been everything that could be desired for pushing work on the Milwaukee Shipyard Company's new dry dock, and in consequence it is well advanced toward completion. If the present mild weather continues, the contractors, Messrs. C. H. Starke & Co., hope to have the dock finished in another month.



ANCIENT AND MODERN PLUMBING-WORK IN LONDON

LONDON, November 27, 1887.

SIR: As a comparison between ancient and modern plumbing I send you rough sketches of old work taken out and new work recently done at an old building in the city of London. The old work was so defective and the smells that escaped from the soil-pipes, etc., had become so bad that it was found necessary to entirely renew the whole of work. Figure I is an elevation and Fig. 2 is a plan of one section of the system The soil-pipes were six inches internal diameter and

were made of cast sheet lead, averaging about nine or

sewage would have full play on the insides of the pipes

sewage would have full play on the insides of the pipes and traps even if the top ends were open. This has been noticed in other cases. The vertical pipes and the under half portion of the branch-pipes were not in the least affected by sewage gases, but this was no doubt because they were thickly coated with fur, which was in some cases nearly an inch thick.

Figure 3 is a view with figured dimensions, and Fig. 4 a section of the traps that were fixed beneath the water-closets. Figure 4 also shows the furred matter that had accumulated inside the traps. One trap had only 2½-inch waterway through, as shown in the section. Pan water-closets were fixed over these traps, which were flushed by means of service-boxes in the cisterns, situated immediately over the pipes, being three-quarters of an inch in diameter. It is probable that plumbers in the olden times did not know the value of ventilation-pipes, and to prevent syphonage of water out of the traps used them extra vent syphonage of water out of the traps used them extra large, fixed soil-pipes so large that they could not charge them full bore, and then, to make extra sure, fixed small-sized service-pipes. There is no doubt, from their point of view, they were entirely successful. It is difficult to surmise what the complication of branch-pipes had been

ELEVATION FIG The Engmering Building Hears Fig.2 FIG.5 ELEVATION g & Building Record" PLAN Fic. 6

ten pounds per foot super; the thickness being about .170 of an inch. The seams were wiped and bore evidence of good workmanship. Instead of the soil pipes being bent to suit their positions soldered elbow-joints were made. As the work had been fixed some 70 or 80 years it is probable that the art of bending large-sized pipes was unknown at that period. The soil-pipes were entirely unventilated, excepting that two of them had been connected with leaden rain-water pipes. From the more modern character of these rain-water leaders there is no doubt they were added in later years. This opinion is strengthened by the fact that the traps and horizontal branch-pipes were perforated that the traps and horizontal branch pipes were perforated by corrosion nearly, if not quite, as much as those that had no ventilation. There were no air-inlets at the bottom of the soil-pipes, they being trapped at the bottom, and in the absence of an air-current, the carbonic-acid gas from

Figures 5 and 6 are respectively elevation and plan of the new work substituted. The main stack of soil-pipe was 4 inches in diameter, with 3½-inch branches to the traps. Each trap had a 2-inch lead vent-pipe branched into a common vent. The common vent-pipes were branched into that at the top of the soil-pipe. The new closets were of the valve description, and were flushed by means of 1½-inch valves, and regulators attached to the apparatus, the service pipes being 1½-inch in diameter. apparatus, the service pipes being 1½-inch in diameter. A stop-cock was fixed in each branch service-pipe, so that if one of the water-closets had to be removed for repairs the other water-closets were not deprived of their water-supply. The whole of the work was executed by Messrs. Dent & Hellyer, and the frequenters of the place now speak highly of the improvements made and also the absence of all smells. Yours truly, J. W. CLARKE.

The interest in the foregoing description is the method of connecting the vent-pipe to prevent syphonage of the trap, which, it will be noticed, is a few inches beyond the water-seal. The account of the plumbing work a hundred years ago will also interest some of our readers. -ED.]

PROPOSED CHECK ON SKIN BUILDERS AND PLUMBERS.

THE New York Board of Health has long realized that certain builders and plumbers have the disposition to willfully ignore the notices of violation of the Plumbing and Tenement-House Acts. This results in many useless inspections, waste of time, and diversion of the force of inspectors (none too large) from current duties.

They have, therefore, decided to invoke the co-operation of General Newton, Commissioner of Public Works, whose department issues permits for water service, in withholding permits from these violators of the law.

We understand that General Newton has received an opinion from the Corporation Counsel that the Board of Public Works is justified in refusing a water permit until the requirements of the Board of Health regulations are complied with. It is proposed to require every application for a water-permit to be accompanied by a certificate from the Board of Health that no violations of the Plumbing or Tenement Acts are existing on record against the building.

It is to be hoped that General Newton will adopt this important and desirable measure, that can be opposed by none except the skin builders, the plumbers who co-operate with them and their partisans, whose influence is not likely to receive his consideration.

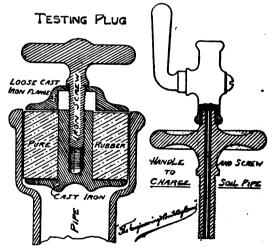
When this desirable measure of protection is secured, the Board of Health should also co-operate with the Water Department to check waste of water by having their inspectors report all instances of this character that come under their notice.

PLUGS USED IN TESTING SOIL-PIPES WANTED.

TORONTO, November 30, 1887.

SIR: Will you kindly give a description of plugs or stoppers used in the testing of soil-pipes and drains, and also state where the same can be procured? By giving this information through your valuable columns you will confer a favor on, Yours truly, SUBSCRIBER.

[Recalling the fact that we once saw a test of soil-pipes in a hotel building in Boston where Mr. John H. Stevens was the plumber, we wrote him for a sketch of the plug he then used. The accompanying illustration is from the sketch he sent us, and his letter is as follows. If any of our readers have different devices we shall be glad to illustrate and describe them:



"In regard to testing plugs, for benefit of 'Subscriber' and others we enclose drawing of our testing-plugs, which we think will explain themselves.
"We can furnish the testing-plugs of any size, if desired.

For further information address

JOHN H. STEVENS & Co., 634 Main Street, Cambridgeport, Mass."

RUBBER BALL FOR TESTING DRAIN-PIPES.

OUR Milwaukee correspondent writes that the plumbers have a great deal of trouble testing the drains. All new drains and extensions must be tested by the plumber when work is done, and the plumbing inspector will call and see the test made, if notified. No work can be covered inside of a building until it has been so tested. Sand bags, bladders, rubber foot-balls, legs of overalls, and other

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devices are used to plug up the sewers, but there are objections to one and all of them. Prederick Hamilton, of Milwaukee, has invented a device for this purpose and did not think it of any value, as he supposed few would be used. His idea is to have rubber balls (that may be made nearly solid) of the sizes of the sewers, 4, 5, 6, and 8 inch. Through these balls a common iron bolt can be inserted, Through these balls a common iron bolt can be inserted, If the nut on this bolt is screwed up after the ball has been placed in position it will be readily seen that the ball will be squeezed against the sides of the sewer so tightly that no water could possibly leak past it. If the plumbers of this country want such a device, it will pay Mr. Hamilton to have them manufactured.

The principle of the expanding plug here suggested seems to be the same as that shown in the sketch sent by Mr. Stephens and illustrated in this issue.

WHY STEAM-TRAPS REQUIRE A SLIGHT PRESSURE IN PIPES TO INSURE THEIR OPERATION.

SIR: In Baldwin's book, "Steam-Heating for Buildings," pages 192 and 193, he says that the return steam-trap operates with vacuum and pressure alternately. Now, the maker of the Curtis steam-trap says it requires one pound pressure in the steam-pipes to elevate the water from the receiver to the trap for every two feet of elevation. Will you please let me know if it requires enough pressure to force the water to the trap same as if the pipe were open at the same height. Respectfully yours, W.

[The trap will work at any pressure above the atmosphere and if the valves are absolutely steam-tight there may be a vacuum. This is not so in practice, however. and the makers guarantee only where there is two pounds pressure or thereabouts to every foot the trap is above the apparatus, for the reason the valves leak sufficiently to soon destroy a vacuum. Also in case of a vacuum, or partial vacuum, it would take longer for the trap to fill, as any little remaining hot water would give off steam

Whether the pipe is open at the top or not does not affect the result, and it will require no more pressure in one case than the other, as the pipe ends in the body of the trap, which is practically open.]

COOKING APPARATUS FOR PUBLIC INSTITU-TIONS.

AKRON, O., December 10, 1887.

SIR: Will you kindly place us in correspondence with ne best manufacturer of steam kitchen and cooking ppliances. We desire to get what information and prices appliances. we can regarding everything necessary for a large hotel or public institution, the most modern and improved. By doing so you will greatly oblige,

Yours truly, WEARY & KRAMER.

[Referred to our readers.]

THE PLUMBING IN THE WELD HOUSE.

WASHINGTON, D. C., December 7, 1887.

SIR: I understand that you do not endorse as correct in principle the house-drainage work which you illustrate and describe without comment, but I think many of your and describe without comment, but I trink many of your readers have the impression that the specimens selected represent not only some of the most elaborate and expensive, but also the approved methods of the time. Certainly, the casual reader of short acquaintance with the of schools, clubs, and public libraries) is not likely to get the idea that the methods shown are notably bad or get the idea that the methods shown are notably bad or wrong. Therefore, when I notice such conspicuous illustrations of "how not to do it," as figures 9 and II on page 10 of the current volume, I am constrained to call your attention to the mischief they may do. I refer to the great number of bends at the right of the basin-outlet, and to the wooden grating under the sink. It may be that the basin waste-pipe is so connected with the main lines of the system that there is no tendency to loss of seal in the trap upon the discharge of a neighboring water-closet; but the plumber's apprentice, for example, finding this illustration as he looks over the journal in the noon hour at the shop, is not apt to reason that this noon hour at the shop, is not apt to reason that this arrangement, while safe in exceptional cases, affords no protection against loss of seal in the majority of situations. It looks like a neat, compact arrangement to a machinist's eye, and it makes an impression in his brain that will some

day, I fear, develop into an imitation.
I fail to understand why, in publishing so conspicuous an example of one of the most common and serious faults in what is called the "fine plumbing" of to-day, it does not seem wise to you to point out the evil and explain the rrect method, even though you may have done it a score

of times already.

If you had added some such note as the following it would, in my mind, have increased greatly the value of the illustration and saved a deal of harm:

"[Of course our plumbing readers of long standing will perceive that this arrangement is seriously faulty, and they do not need to be told why. To our new and inexperienced readers we explain, that the main object of trap ventilation being to prevent loss of seal from a suddenly

creased or diminished pressure in the waste-pipe below he trap, the vent-pipe shown in the illustration is in the main useless, because of the obstruction to the full and rapid movement of the air offered by the five sharp turns rapid movement of the air offered by the five sharp turns in so short a distance. The air-pipe should have been attached on the bend below the trap, forming a nearly straight continuation of the vertical portion of the wastepipe (of the same size) and turning back to the wall by a long, easy curve, making only one bend (in the course shown) instead of five.]"

The wooden grating is much less dangerous, for it is to be presumed that a house having such elaborate fixings would have a neat housekeeper—and surely no neat housekeeper would long tolerate such a dirt-accumulator.

keeper would long tolerate such a dirt-accumulator.

Dana C. Barber.

[Our correspondent is too extreme in his criticism in this case. It is always desirable to have as few bends as possible in an air-pipe, yet in practice elbows or bends cannot always be avoided, for obvious reasons, though there might have been one less in this case. Of course, long bends present less resistance than short ones to the passage of air, but this matter must be treated from the practical side as well as the theoretical.

The member of our staff who made the sketches from which our illustration was made states that to obviate the resistance due to bends and long pipes, diameters have been increased until sizes have been reached which seem to answer all practical purposes, in this case as well as others. Moreover, in this job the length of the backair pipe to the point where it joins the vertical cast-iron pipe is inconsiderable.

With regard to the wooden grating under the sink, the drawing should have shown it in sections. It must be remembered it was for a special purpose. The sink, as was stated, was for a photographer's use-undoubtedly for amateur photography. It was in the dark-room, and had a leaden safe under it. On this safe was laid the wooden grating to prevent slipping, etc.; and though it might be objectionable under a kitchen or slop sink, we see nothing to criticise in this case, as the grating can be lifted out and washed-an advantage a wooden floor would

Our descriptions of current work are selected, as our correspondent has intimated, as matters of interest to architects and plumbers. In this, as in every other construction illustrated, it is not intended, nor do we believe is it understood by our readers, that we endorse every detail shown. Whenever we consider a matter dangerous we call attention to it, but the purpose of presenting the different methods in vogue in different cities is to facilitate comparisons, furnish suggestions, and elicit discussion from our technical readers. Our opinion as to what we should do in a given case we give in our answers to questions. If we acted on the advice of our correspondent to select any detail that we did not fully approve of, in every piece of work that we were permitted to illustrate, as a text to condemn the practice, opportunities for illustrating anything, from a roof to plumbing, would soon be withdrawn

Moreover, our readers perfectly well know our position on this matter of vent-pipes on traps. It often happens that to secure neatness in appearance a compromise from the theoretical ideal is adopted; while we might not do it ourselves, we do not feel justified in criticising others who elect to do so if no danger is incurred thereby.

Indeed, in nearly every piece of work we illustrate this question comes up. Within reasonable limits, therefore, we prefer to leave criticism to our readers.]

THE MOTIVE POWER OF THE WORLD.

(From the London Times.)

FOUR-FIFTHS of the engines now working in the world have been constructed during the last twenty-five years. France owns 49,590 stationary or locomotive boilers, 7,000 locomotives, and 1,850 boats' boilers; Germany has 59,000 boilers, 10,000 locomotives, and 1,700 ships' boilers; Austria, 12,000 boilers and 2,800 locomotives. The force equivalent to the working steam-engines rep-

resents—in the United States 7,500,000 horse-power, in England 7,000,000 horse-power, in Germany 4,500,000, in France 3,000,000, and in Austria 1,500,000. In these figures the motive power of the locomotives is not included, whose number in all the world amounts to 105,000, representing a total of 3,000,000 horse-power. Adding this amount to the other powers, we obtain a total of

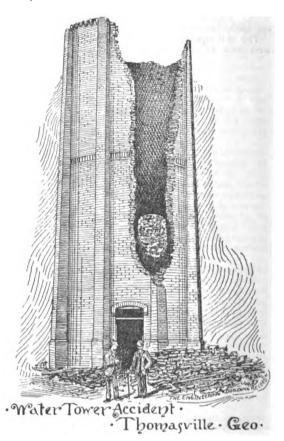
A steam horse-power.

A steam horse-power is equal to three actual horses' power; and a living horse is equal to seven men. The steam-engines of the world represent, therefore, approximately the work of 1,000,000,000 men, or more than double the working population of the earth, whose total population amounts to 1,455,923,000 inhabitants. Steam has accordingly trebled man's working power, enabling him to economize his physical strength while attending to his intellectual development.

THE RUINED WATER-TOWER AT THOMAS-VILLE, GA.

WE have received from a correspondent in Thomasville photograph of the water-tower in that town, whose destruction we described in our last issue, and reproduce from it the accompanying illustration, which tells the story very plainly.

The first accounts ascribed the fall of the central pier, which was the immediate cause of the disaster to the vibrations of the hod-elevator. Our correspondent thinks from an examination after the accident, that the fall of the central pier was due to unequal settlement. Probably both causes operated together, each intensifying the effect of the other, until the equilibrium of the pier was destroyed.



Some of the settlement observed after the accident may have been the effect rather than the cause of the overthrow, as while the pier was going over its entire weight would be borne on a small portion of the side toward which it leaned, and the increase thus caused in the intensity of the pressure would almost certainly cause more or less compression or settlement of the foundation.

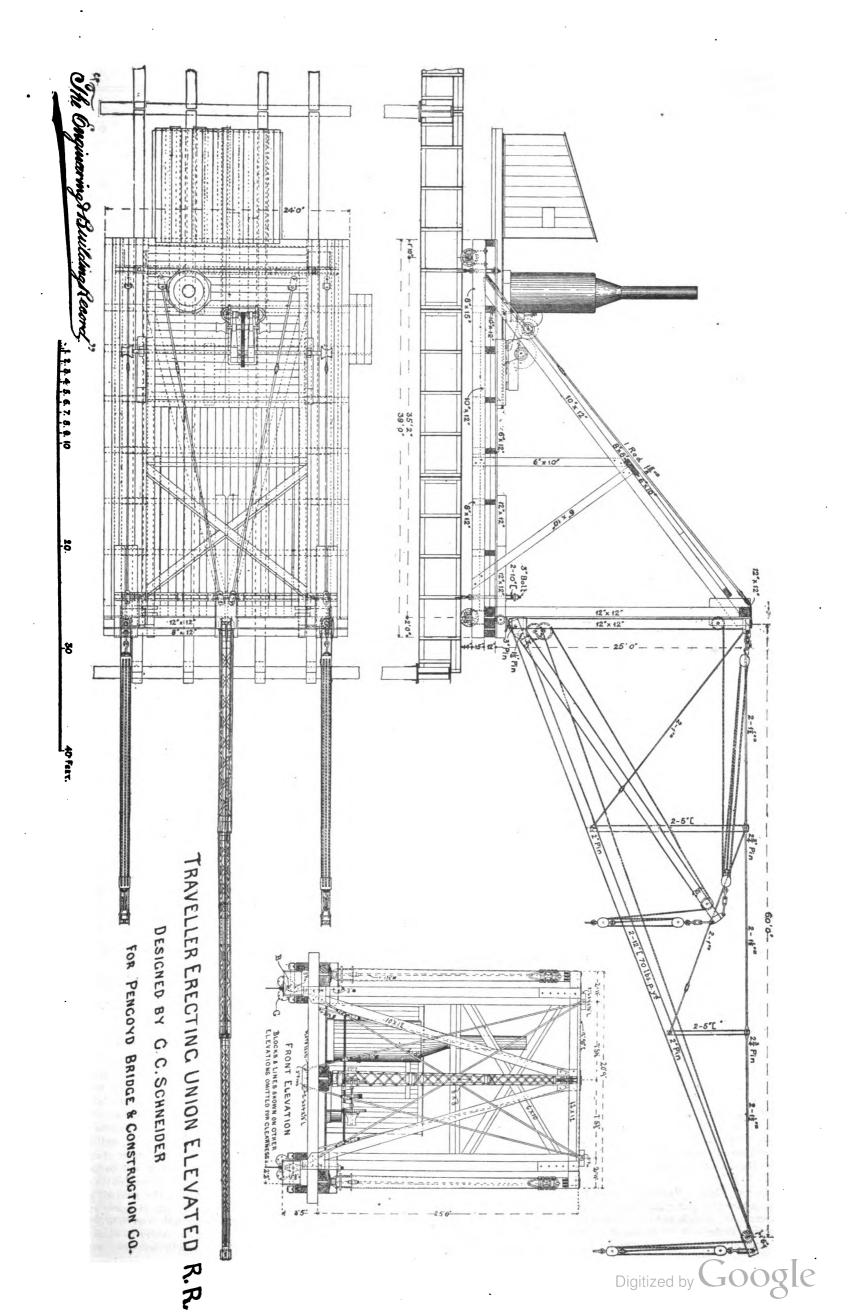
In endeavoring to account for an accident it is often difficult in examining the wreck to distinguish cause from effect, though, of course, all pains should be taken to do so. The writer well remembers an accident which occurred on a building whose erection he was superintending, which at first glance seemed unmistakably due to the giving way of an eye-bolt to which a tackle was attached, when subsequently investigation showed conclusively that the eye-bolt was the last thing that gave way and that the disaster was due to an altogether different cause.

PROJECTED RAILROAD IN BUENOS AYRES BY AN AMERICAN ENGINEER.

THE Philadelphia Times says:

"Henry Mactier, a well-known civil engineer of this city, will sail for South America on December 13, to project a railroad for a syndicate of English capitalists. His destination is Buenos Ayres, Argentine Republic.

"The proposed road, with its branches, will extend from Buenos Ayres to Pergamino and Cordoba, a distance of 450 miles across the pampas. The Government has granted a subsidy of \$700,000 and a guaranty of six per cent. annual income upon the investment. The failure of the United States to form a treaty with its sister republic has created a sentiment of discrimination in the Argentine Republic against the United States. When contracts for railroads are let the specifications call for English steel and English iron. Mr. Mactier is in communication with New York parties who are seriously contemplating taking advantage of the favorable subsidies offered by the Argentine Republic, and if further railroad construction is feasible the advantages will be reported to the New York capitalists."



BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXVII.

(Continued from page 11.)

SIX-TON UNIVERSAL TRAVELING CRANE FOR ELEVATED ROAD ERECTION.

THIS traveling derrick, designed for the Pencoyd Bridge and Construction Company by C. C. Schneider, their chief engineer, to be used in erecting the section of the Union Elevated Railroad, in Brooklyn, for which they are contractors, is so fully shown and dimensioned in the accompanying illustrations as to need little explanation and less comment. This description, promised in our issue of November 16, but held over for more complete drawings, was proposed before the accident therein described, and will be of additional interest as showing that mishap to have been due to no fault of the crane. arrangement, connections and details of this traveler have been designed with more than ordinary care, and corresponding good results have been secured in its performance. Its operation is as follows: The permanent structure being completely assembled and bolted up to the last pair of columns, the traveler is advanced until the front wheels nearly reach the last transverse girder; the grips G (see front elevation) then clutch the top chord of the longitudinal girder, and are locked fast by the bolt B; the sixty-foot iron derrick in the centre then sets the next pair of columns, placing them in their pedestal sockets and lifts the transverse girder into position on top of them; then the side derricks raise the longitudinal girders, the bolting of the section is completed, and the operation repeated on the next section, leaving the riveting gang to follow at a convenient distance.

The long centre derrick is not adjustable vertically, but the side booms can be raised or lowered by the mast-head tackles.

Each derrick is designed for a maximum load of 12,000 pounds, its greatest possible duty, and figured for low unit strains.

Fourteen-inch triple-sheave purchase-blocks, with falls 1½ inches in diameter, are used for all the hoisting tackle. Each hoisting fall is carried to the centre of the mast of its derrick, just above the boom connection, and axially down through the hollow bearing and from the fixed sheave below direct to the winch-heads. The fall of the centre derrick thus leads directly to the winch-heads on the hoisting engine, and those of the side derricks to a pair of winch-heads on the extremities of a long transverse shaft, thus avoiding snatch-blocks and short turns.

Special pains have been taken to avoid any tendency to "kick" on the part of the base-blocks on which the derricks rest by giving them ample bearing surface and strongly securing them.

The engine is a standard "four-winch reversible hoister," designed and built by Copeland & Bacon, of New York. It is identically the same as that used on the traveling derrick of the Phænix Bridge Company in the erection of the Kings County Elevated Railroad, described and illustrated in our issue of June 4, except that one of the transverse shafts has been lengthened so as to secure a straight lead for the side derricks.

The total weight of the traveler, including engine and boiler, is about 72,000 pounds.

(TO BE CONTINUED.)

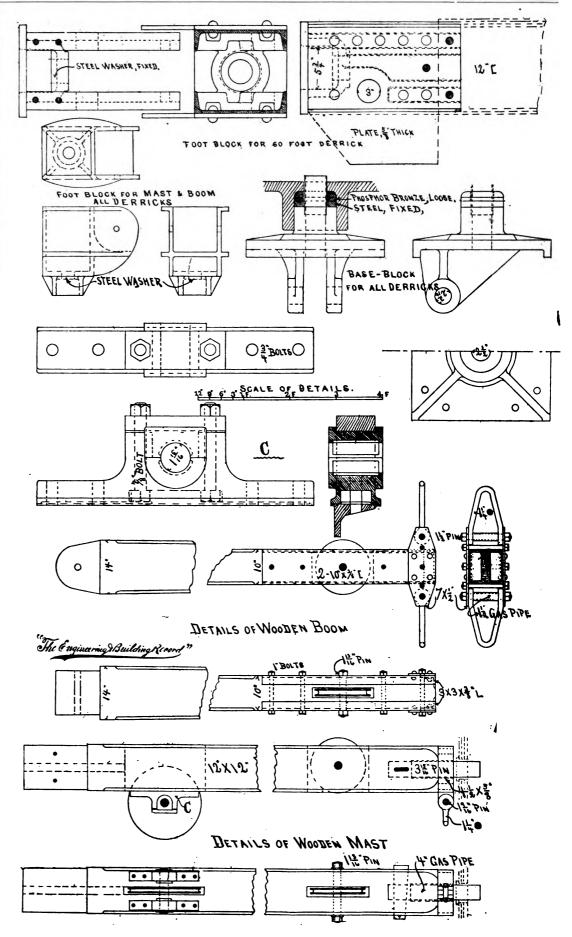
THE NEW ENGLAND WATER-WORKS ASSOCIATION.

THE December quarterly meeting of this society was held at Young's Hotel, Boston, on Wednesday, the 14th inst., with an attendance of seventy-five members and guests. At a business meeting before dinner the following gentlemen were elected to membership:

Active—Josiah S. Marcy, Treasurer, Gardiner, Me.; Weston Lewis, Treasurer, Waterville, Me.; Ezra Clark, President, Hartford, Conn.; Henry W. Ayres, Engineer W. W., Hartford, Conn.; William H. Thomas, Assistant Superintendent, Hingham, Mass.; Frank A. Andrews, Assistant Superintendent, Nashua, N. H.; J. C. How, Superintendent, Bath, Me.; A. I. Jones, Superintendent, New Brunswick, N. J.

Associate—Turner, Clark & Rawson, Boston; M. J. Drummond, New York; T. J. McKenna, New York.

Lunch was served at 1 o'clock, and was followed by an interesting paper by Professor T. M. Drown, of the Massachusetts Institute of Technology and Chemist to the



DETAILS OF ERECTION TRAVELER USED BY THE PENCOYD BRIDGE AND CONSTRUCTION CO., ON UNION ELEVATED RAILROAD, BROOKLYN.

Massachusetts State Board of Health, on "The Odor and Color of Surface Waters." The paper will be published in full in the journal of the association and we can at this time only note some of the leading points.

Dr. Drown called attention first to the fact that there is no necessary and inevitable connection between the color and odor of water, though the determination and measurement of each are important factors when taken in connection with other results of a complete examination. He described the methods followed in the determination of these points, and enumerated the terms employed to express the relative degrees and characteristics of each. The odor given by a water when cold may be the same as that given from the same water hot, or it may be en-

tirely different, and a careful distinction was made between an odor which is ready formed in the water and one which the water is capable of generating under the influence of chemical action. Some connection exists between the color of water and the quantity of albuminoid ammonia found on analysis, and an experienced analyst can predict, with some degree of confidence, the quantity of this substance which will be found in a given sample of water, by a measurement of the color according to an arbitrary scale. The removal of coloring matter by alumina has, in certain cases, reduced the amount of albuminoid ammonia from 69 to 83 per cent.

The albuminoid ammonia which remained after treatment by alumina in these cases was probably an indica-



UNION ELEVATED RAILROAD, BROOKLYN-PENCOYD BRIDGE AND CONSTRUCTION CO.'S ERECTING TRAVELER.

tion of colorless nitrogenous animal matter in the samples. Dr. Drown thought that the light suspended matter in potable water should not be removed before chemical examination, because it is not removed before reaching the consumer.

An ordinary sand filter may be rendered effective in the matter of removing color by the addition of clay or loam, and, in doing this, the amount of albuminoid ammonia will be reduced.

The fact was noted that a high color does not prove that the water is not safely potable, for the coloring matter may come from vegetable matter in no condition tending to decay. The paper closed with a word of caution against hasty conclusions from the figures of water analysis, and referred to the necessity of supplementing the examination in the laboratory with a careful study of the conditions in the field.

The paper was followed by a discussion brought on by questions addressed to Dr. Drown by different gentlemen, in which the methods of water analysis were briefly indicated, the value and meaning of the results were explained, and the impossibility of setting up any fixed standard of purity plainly stated. The practical value of the systematic analysis of waters from all parts of the State which is now being carried on under the direction of the State Board of Health was shown and endorsed in the remarks of Mr. Stearns, Engineer of the State Board, Mr. Fitz Gerald, of the Boston Water-Works, Mr. Allen, City Engineer of Worcester, and others, and the meeting adjourned to meet the second Wednesday in January, 1888.

THE ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting of the Club was held on December s.

There were present Messrs. William B. Knight, C. E. Taylor, J. A. L. Waddell, T. F. Wynne, B. L. Marsteller, S. A. Mitchell, H. G. Wade, C. H. Talmage, A. J. Mason, W. Kiersted, K. Allen, secretary and treasurer, and six visitors.

The secretary then read, in the absence of the author, a paper entitled "Deviation of the Ship's Compass," written for the Club by Mr. H. C. Pearsons, of Ferrysburg, Mich.

After a brief discussion, a vote of thanks was extended to Mr. Pearsons for his valuable paper, and to Mr. Kiersted for the paper presented at the previous meeting.

Mr. J. A. L. Waddell then read some abstracts from a paper on "General Specifications for Highway Bridges of Iron and Steel," describing at length the letting of county bridges, with some defects of methods in use.

Notice was given by the president that the annual meeting would be held December 19, after which the meeting adjourned.

THE ENGINEERS' CLUB OF PHILADELPHIA.

THE Engineers' Club of Philadelphia held their usual business meeting on December 3. President T. M. Cleemann occupied the chair and thirty-eight members were present. Officers for 1888 were nominated. Mr. Percy T. Osborne presented an illustrated paper on the Palmetto Railroad, the connecting link in a new through line to the South. Mr. R. B. Osborne presented an illustrated paper upon the Unaccountable Deficiency in the Track of American Railways. Mr. Osborne deprecated the continued use of the unsatisfactory spike and offered a suggestion for a spike-headed bolt—partly in accordance with established English practice and partly of his own design but unpatented—to pass entirely through the tie.

THE LONG-PROMISED UNDERGROUND RAILWAY.

SIR: The opportunity for an underground railway presented by the proposed widening of Elm Street is, indeed, inviting; principally because it seems to permit the construction of a road with all the advantages and few of the disadvantages of the Arcade plan. The consent of property owners cannot reasonably be withheld; the interference with street travel and with pipe-service during construction and many similar objections are at once set aside. Many of the best streets of London and a large portion of the underground railway of that city are indebted for existence to the ability of the parties most in interest to unite on joint plans of construction.

on joint plans of construction.

General New on, in an interview published last week, characterizes the building of New York City as seemingly "due to chance, and a very bad chance." It is to be hoped that in the inception of such an undertaking as the Elm Street improvement, over and under ground, enough time will be allowed and sufficient skill displayed to insure the city something more than a simple street opening of the old school. Here is an opportunity to build a street the equal of Broadway, with the advantage of providing for rapid transit of an improved form.

Rapid transit seems to have come to us heretofore as the result of chance, and without the benefit of very carefully considered plans. The underground plans are in this respect worse than the elevated. The Arcade railway gave us the gist of its present plan twenty years ago, and in some respects its most recent plans are more stupid than those first presented. A single-cross-section of a street suffices to hang an entire scheme upon, while the real railway difficulties, engines, cars, connections with other lines, crossings, terminals, stations, etc., are scarcely considered. Yet we are told that the construction of this railway is to be commenced immediately.

railway is to be commenced immediately.

In the Elm Street project it seems as though we were to get a section of underground much on the same principle on which Mrs. Toodles secured the door-plate, because it was cheap, and might, under certain favorable

conditions, be useful. A careful consideration of the transit problem shows that it is absurd in a city like New York, to think of having any line unless forced into a street either entirely in tunnel or entirely in viaduct; both systems must be used to get the best effect.

With engines as at present constructed it is hardly probable that three miles of continuous tunnel could be operated with rapid-transit trains with any comfort to the passengers; this has never yet been done in city railways, I believe. Under a street like Elm Street or Broadway it is impracticable to discharge smoke or receive air even at definite points. Much can be done with coke as fuel and the improved mufflers, but not all, and the steam locomotive is still our best if not our only locomotive. Again, accidents will happen; we must not expect anything else with human frailty, and the light of day and exit from the top of the tunnel at convenient and frequent intervals is a necessity.

The ideal railway is located through the blocks between the streets as far as practicable, elevated over valleys like that at Canal Street and where it may be necessary to connect with surface or elevated railways, and underground in all other places, deep enough often to go under the sewers. It is provided, wherever opportunity presents, between the houses in blocks and at other points, with breathing spaces or well-holes. The injury to property and the interference with local improvements and with public comfort are not so great in such a line, and the road has more freedom in construction and operation than on a continuous viaduct. If right of way must be purchased the valuable portion of it, so much as fronts on the cross streets, can be utilized. This kind of an underground I hope we shall one day obtain.

What is needed in New York City is not so much more north and south lines as greater comfort for passengers and better means of communication between other lines of travel. The elevated roads have four splendid routes through the city, and we are promised that double the number of passengers now carried will be carried over these routes in the near future. The limit of the structures, long ago predicted as at hand, is now reached, while the inability to use heavy engines forbids the running of long trains and the much-needed increase of speed. Heavy engines are required for short stops at stations, and for great speed between stations. We were very tired of the horse-cars and welcomed the elevateds with open arms. It is probable that we shall be just as tired of the elevateds before we get our first underground line, and shall extend just as warm a greeting to it.

This metropolis has three large rivers in its midst, none of which can be bridged as simply as the Thames or the Seine, and two of which should not be bridged more than once. Our western connections cannot depend in the future ent rely on the ferries, and tunnels must follow the opening of any underground road. In January, 1886, the Brocklyn Bridge Kailway, after being in operation two years, carried 60,000 passengers daily. It now transports 90,000 daily, and 10,000 to 12,000 per hour during the busy hours of the day. Twenty miles of new elevated railway in Brooklyn means a development of population and transportation more or less tributary to our city railways, which one bridge will be all too small to accommodate, and an East River tunnel will be sadly needed before we get it.

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The business island below Canal Street is, fortunately, high above the tide, and composed of a splendid building sand, free from rocks or boulders; for tunnel purposes it rivals the boasted London clay. Real estate is so valuable in this district, and building space so limited, that within thirty years all the steam railways and all the passenger and freight depots, which will be necessary in this district, should be found below the surface of the ground. From subterranean depots lines will extend across both rivers, and in various directions uptown. It is unwise to predict how extensive the underground traffic will become when once commenced. This city will certainly te the largest in the world, and that quickly. Capital will be ready to build on well-formed plans. Let Elm Street be ready to build on well-formed plans. Let Elm Street be opened, and let the underground be built beneath it if you must. I protest only against a chance consideration of the subject of underground transit. It is not enough to build lines merely to compete with the elevateds. must build better lines, profiting by their shortcomings and by the ten years' experience which they have given us. Build a structure, then, which your grandchildren shall be proud of, and such as to adjust itself easily to the extensions and connections which will be made on all sides; such a one as our memorial increasing in a rapid progression, shall not soon over reach.

Yours respectfully,

INTER-METROPOLITAN. sides; such a one as our metropolitan transit, evershall not soon over-

DOES A SANDSTONE PEDESTAL NEED BOXING?

MISS WHITNEY, the sculptress of the Erickson statue at Milwaukee, has written to suggest that the pedestal of the statue on the lake bluff be covered during the winter to protect it from the severe frosts. The sandstone is expected to grow harder and firmer with exposure, but Miss Whitney thinks some protection should be had for the first winter. The matter has been referred to the Board of Public Works. The board thinks that a recent sudden change of temperature has been as severe a test as it will have, and as the pedestal has not been injured at all by it they are of the opinion that no covering is necessary.

We think that sandstone is much more likely to be injured if at all by changes of temperature, even if small, just about the freezing point—i. e., alternate freezing and thawing -than by much greater changes which do not pass the freezing point.

It is the harder stones such as granite that are most apt to be injured by great and sudden changes in temperature, which are most likely to occur on a clear winter morning following a very cold night, when one side of a stone cooled perhaps to many degrees below zero is suddenly exposed to the direct rays of the sun, and thus rapidly heated while the mass remains cold. The unequal expansion thus caused has been known to produce cracks, and if water once enters frost will speedly complete the destruction.

We commend to the perusal of such of our Milwaukee friends as may be interested in the preservation of their statue and its pedestal, the article found elsewhere in this issue on the deleterious effects of snow on exposed works

COLONEL ADAMS' RECEPTION TO WILLIAM E. WORTHEN.

NOTWITHSTANDING the very stormy day, the reception by Colonel Julius W. Adams and Mrs. Adams to the retiring President of the American Society of Civil Engineers, held on Thursday evening last at their residence in Brooklyn, was very well attended, and proved a highly enjoyable and very successful affair. Among those we recall as being present were: Past President Mr. and Mrs. Francis, of Lowell; General John Newton, Hon. J. S. T. Stranahan, Mr. and Mrs. B: S. Church, Mr. and Mrs. Wellington, Mr. and Miss Croes, Mr. and Mrs. J. F. Ward, Mr. Lebbius Ward, Mr. Asserson, Mr. Beckwith, Mr. Bogart, Mr. Brackenridge, Mr. and Mrs. H. W. Brinckerhoff, Mr. and Mrs. A. G. Brinckerhoff, Mr. Bryson, Joseph P. Davis, Mr. and Mrs. Charles E. Emery, J. Forster Flagg, Mr. and Mrs. Henry Gielow, General George S. Greene, Mr. George S. Greene, Jr., Mr. S. S. Haight, Mr. Charles W. Hunt, Mr. William R. Hutton, Mr. C. C. Martin and daughter, Mr. and Mrs. E. P. North, Colonel William H. Paine, Mr. S. R. Probasco, Mr. and Mrs. William Rumble, Mr. J. F. Sorzano, Mr. D. McN. Stauffer, Mr. J. H. Striedinger, Mr. Robert Van Buren, Captain E. B. Van Winkle, Mr. and Mrs. John F. Ward, Mr. Charles D. Ward, Mr. L. B. Ward, Mr. Arthur M. Wellington, Mr. and Mrs. Thomas D. Whistler, Mr. and Mrs. Henry C. Meyer.

ADDRESS OF DEALERS IN ASBESTOS AND PIPE-COVERINGS WANTED.

BUFFALO, N. Y., December 14, 1887. SIR: I am desirous of entering upon the business of covering steam pipe with asbestos and hair-felt. I am unable to get information from local dealers as to the address of firms supplying that class of goods. I have read your valuable paper since '81, and now beg, as a that you give me the desired information.

Information wanted concerning asbestos, plaster, in barrels; asbestos, fibrous, in sheet; hair-felt, different thicknesses; mineral wool, other than Cleveland make.

F. J. Tolles,

262 N. Division Street.

[Referred to our readers. You will find in our advertising columns firms who deal in these materials.]

EIGHTEENTH ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF HEALTH.

UNDER a State act of 1886, the State Board of Health of Massachusetts has been re-established upon substantially the same basis as that which it had eight years ago, although with increased duties and powers. The organization of the new board was effected in May, 1886, and the eighteenth annual report of the board before us really covers a period of but four months, and is interesting rather because of the indications which it gives of the purposes of the board than as a record of work accomplished. . It contains, besides the general report, a special report

of the results of an inquiry into the transmission of infectious diseases through the medium of rags made by Dr. Charles F. Withington; reports on food and drug inspection; weekly mortality reports; reports on the health of towns, and a "Manual for Boards of Health."

The report of Dr. Withington is a carefully prepared paper embodying the results of extensive research, and as Massachusetts consumes one-third of all the rags used for manufacturing purposes in this country, it is evident that his field of inquiry was large enough to give valuable results. The magnitude of the interests involved may be inferred from the fact that the census of 1880 showed that in that year the consumption of rags by the paper industry amounted to 187,917 tons, and the value of the product to \$55,109,914. About forty per cent. of the rags thus used come from foreign countries, and it is with regard to these imported rags that the controversy as to the necessity for using a patent system of disinfection has chiefly occurred.

Dr. Withington gives a detailed account of the methods of collecting and handling rags, a historical sketch of the disinfecting regulations, and statistics of the health of paper mills and their vicinity so far as probably affected by rags. The conclusion, as summed up in the report of the board, is that "in Massachusetts no infectious disease has ever been traced directly to the medium of imported rags, except small-pox, and that disease in a very few instances only. Not a single case of scarlet fever, typhoid fever, diphtheria, cholera, or anthrax has ever been shown conclusively to have been transmitted by rags imported as such from countries outside of the United States." die of the United States." Dr. Withington remarks that despite the fact that cholera is not known to have ever conveyed to this or any other country in foreign baled rags, it is a reasonable precaution to prohibit the landing in any United States port of rags gathered in epidemically infected localities. * * * Such prohibitions should be limited to the time and place of epidemic infection; but all necessary precautions should be taken to make sure that rags shipped from a healthy port were not gathered or baled in an infected place." He points out that systematic enforcement of vaccination and revaccination among papermill operatives is the only safeguard against the chief danger from rags, and that "as domestic rags comprise more than half those used, and represent a still larger proportion of the infection likely to be carried, it follows that they should participate in whatever disinfection is thought necessary. This fact points to the paper mill as the proper place for making such disinfection." The italics are ours

The reports on food and drug inspection by the officer of the board are, as usual, very valuable. This branch of sanitary work has been better managed in Massachusetts in any of our States, and the reports of work done contain substantial new information rather than quotations from foreign authorities and declamatory statements about the way people are being poisoned.

The reports on the health of towns are chiefly of local

interest, and educational in character.

The "Manual of Health Laws" is a summary of all

laws and decisions up to date, and seems to be an excellent piece of work. An important part of the report is that relating to the water-supplies of the State, which is noticed in our editorial column.

The people of Massachusetts are to be congratulated their present State Board of Health. Its plans for on their present State Board of Health. Its plans for future work are wise, and on broad lines, and every facility should be given to it for carrying them out.

THE CLOCK AND BELL TOWER COMPETITION.

THE forty-four designs for the "Memorial Clock and Bell Tower on a Village Green," entered in competition for the gold and silver medals of the Architectural League were on view to art writers on the 14th inst. at 10 West Twenty-third Street, the office of the Secretary. One design was thrown out for want of compliance with the programme.

All drawings were signed with motto or cypher, and the name and address of the authors will not be known until the evening of the reception, the 17th.

The gold medal was given to a design bearing a cypher of three towers charged upon a shield; the silver medal to the design signed "Tuxedo," and honorable mention to "Mephistopheles," "Villager," and a T charged upon a shield, the whole surrounded by a laurel wreath.

The gold-medal design is a low square tower pierced at the base by four broad arches. The walls are boldly battered and the tower is crowned by a belvidere covered with a low pyramidal roof. The large arches are in cut stone, while the walls are built of the rough field boulders.

The effect is quiet, simple, and unpretending. The whole structure is some twenty feet square at the base, and perhaps not over thirty-five to the top of the roof, and eminently fitted to the conditions of the problem.

The perspective is rendered in pen and ink in a most masterly manner; indeed, it is a pleasure to see such a strong, vigorous, and dignified drawing in these days of childish mannerisms among draughtsmen.

The only objectionable feature in this design is the enormous size of the wrought-iron clock-dial, it being perhaps twelve feet in diameter at a height of twenty from the ground.

The silver-medal design is a rather labored and delicate pen-and-ink drawing of a tower crowned by an ugly concave roof of too high pitch. It is designed to be executed in brick and stone in a style modelled after the French manoires.

Above the first story the front of the tower sets back, one corner being carried up as a turret. It would be supposed that this would contain the staircase, but upon on inspection of the plan it is found to be put to the purposes of a closet. A feature, charming in itself, is thus rendered abortive. The design, however, well merited the second place by reason of its general fitness.

Of those honorably mentioned the design of "Mephistopheles" ranks first. It is a beautifully rendered watercolor of a tall stone tower, strongly influenced in design by the clock-towers of Lombardv.

The treatment of the top-two bells in two arches, the whole under one arch and a roof and backed by a belvidere-is charming in its picturesqueness, while yet restrained and dignified. The tower is too tall, somewhat "wire-drawn" in fact, while the portico at the entrance is weak, almost childish. Had a quarter of the height been taken out of this tower it would probably have secured the second place.

These three designs are far and away the best. The two other designs mentioned are great, square stone towers, strongly influenced by the Gothic, that of "Villager" being the best.

Other designs worthy of note are those bearing the motto "Seats of my Youth, etc.", which, it is strongly suspected, is by the author of the gold-medal winner, "Quilp," in Romanesque; "Cacelia von Donatello" (sic), in the same style: "Nobody," "Romano," "Simplex," who has just missed a good thing; and "Time Flies," a beautiful pen-and-ink drawing, but a most ill-considered

As a whole, the competitors have missed the spirit of the programme, but have at the same time made careful studies, and with marked and creditable success.

It is worthy of note that the designs receiving the medals are both rendered in pen and ink, while the mentioned drawings are all in color. Whether it is owing to conditions obtaining at this special exhibition, or extending throughout draughtsmen generally, cannot be stated, but it seems true that our young men are stronger with the nen than with the brush. The result of this first the pen than with the brush. competition has been very satisfactory, and augurs well for those to come.

THE chief of the German Admiralty has issued instructions that, as whole black pepper absorbs moisture, steel pens, keys, and small iron and steel articles should be stowed with black pepper to preserve them from rust on board ship. White pepper does not possess such hygroscopic properties.



WORCESTER, MASS., PLUMBING ORDINANCE. ADOPTED NOVEMBER 25, 1887.

SECTION 1. The Board of Health may license proper persons to carry on the business of plumbing.

persons to carry on the business of plumbing.

Sec. 2. No person shall carry on the business or do any work of plumbing, unless he shall have first obtained a license and registered his name and place of business in the office of the Board of Health, and notice of any change in the place of business of a registered plumber shall be immediately given to said board. Provided, that this section shall not apply to employees while working for licensed plumbers. licensed plumbers.

licensed plumbers.

SEC. 3. Every dwelling-house where a public sewer abuts the estate shall be supplied with a water closet for every fitteen persons, conveniently located and constantly supplied with water. All water-closets constructed after the passage of this ordinance must be supplied with water from a special rank or cistern not used for any other purpose. a special tank or cistern, not used for any other purpose unless permission has been first obtained from the Board of Health to use other fixtures. It shall, in all cases, be connected directly with the general or common drain-pipe of the house. The common drain-pipe shall be separately and independently connected with the public sewer, wherever such sewer is provided, and if there is no such sewer, with a properly constructed cesspool of a capacity approved by said board.

SEC. 4. Where it is necessary to lay soil pipe under the ground, it shall be of the quality known as "Extra Heavy Pipe." The length passing through the walls of the building shall also be of extra heavy pipe. All cast-iron pipes must be sound and free from holes and other defects, of a uniform thickness and of not less than the weights specified below for the corresponding diameters, and before use unless permission has been first obtained from the Board

fied below for the corresponding diameters, and before use shall be thoroughly coated inside and out with coal-tar or an equivalent substance.

External diameter, ordinary pipe:

2 inches 3½ pounds per foot. 5 " 8 6 " ro

Extra heavy pipe, external:

2 inches 5½ pounds per foot.

Extra neavy pipe, external:

a inches 5½ pounds per foot.

3 " 9½ " "

4 " 13 " "

5 " 17 " " "

6 " 20 " "

Drains and soil pipes through which water and sewage is used and carried shall be of sound iron when within a building, and for a distance of not less than five (5) feet outside the foundation walls thereof. They shall be securely ironed to walls or laid in trenches of uniform grade, or suspended to floor-timbers by strong iron hangers or as the said board may direct. They shall have proper fall towards the drain or sewer, and soil-pipes shall be carried out through the roof, open and undiminished in size, to a distance not less than two (2) feet above the roof or as the said board may direct. Changes in direction shall be made with curved pipes, and all connection with pipes shall be made with Y-branches. Every waste-pipe used for conducting waste-water from sinks or other fixtures shall be carried through the roof, open and undiminished in size, to a distance not less than two (2) feet above the roof or into soil-pipe above highest fixture.

SEC. 5. Rain-water leaders must never be used as soil,

SEC. 5. Rain-water leaders must never be used as soil, waste or vent pipes, and when connected with soil or drain pipe shall be suitably trapped.

SEC. 6. Sewer soil-pipes or waste-pipe ventilators shall not be constructed of brick, sheet metal or earthenware, and chimney flues shall not be used as such ventilators.

SEC. 7. Joints shall be run with molten lead, packed with oakum, and thoroughly calked and made tight. Connections of lead pipes with iron pipes shall be made with brass ferrules, properly soldered and calked to the

SEC. 8. Every sink, basin, bath tub, water-closet, slop-SEC. 8. Every sink, basin, bath tub, water-closet, slophopper, and every fixture having a waste-pipe shall be furnished with a trap. Traps shall be protected from syphonage or air-pressure (when such make of trap is used that is liable to syphonage) by special air-pipes of a size not less than the waste-pipe; but air-pipes for water-closet traps shall be of not less than 2 inch bore. Air-pipes shall be run as direct as practicable, and shall not be of less than 4-inch bore where they pass through the roof. Two or more air pipes may be connected together or with a soil-pipe; but in every case of connection with a soil-pipe such connection shall be above the upper fixture of the building.

Sec. 9. Waste pipes from refrigerators, or other receptacles in which provisions are stored, shall not be connected with a drain, soil-pipe or other waste-pipe, unless such waste-pipes are provided with traps, suitably ventilated; and in every case there shall be an open tray between the trap and refrigerator.

SEC. 10. Pipes and other fixtures shall not be covered or concealed from view until after the work has been examined by the said board, and the plumber shall notify said board when the work is sufficiently advanced for inspec-

SEC. 11. No steam-exhaust shall be connected with any soil or waste pipe or drain which communicates with a public sewer.

SEC. 12. A grease-trap shall be placed under the sink of every hotel, restaurant, eating-house, or other public cooking establishment.

SEC. 13. For every license granted under the provisions of this ordinance there shall be paid to the clerk of the Board of Health the sum of one dollar for the use of the

Sec. 14. All previous ordinances, rules and regulations inconsistent herewith are hereby repealed.

MILWAUKEE ORDINANCE PROVIDING FOR SAFETY IN THEARES, ADOPTED DECEMBER 5, 1887.

THE Mayor and Common Council of the city of Milwaukee do ordain as follows:

SECTION 1. It shall be unlawful for any person, persons, or corporations to hereafter use or permit to be used any building or structure for the purposes of theatrical or public entertuinments in the city of Milwaukee, unless the provisions hereinafter contained shall have been fully complied with, and any person who shall be convicted of violating the provisions of this ordinance shall forfeit of not more than one hundred nor less than twentyfive dollars.

SEC 2. All buildings used for theatrical or public entertainments shall have a water stand-pipe and water-plug to be placed on the stage or platform, or in its immediate vicinity, which shall be connected with the water-pipes of street-mains in the street corresponding with stand-pipe and with the hose-coupling of the fire depart-ment of the city of Milwaukee, and shall be put in under the direction and to the satisfaction of the Chief of the Fire Department and Inspector of Buildings.

Fire Department and inspector of buildings.

Sec. 3. Standard hose of the kind used by said fire department shall be attached to such stand-pipe of such size as may be directed by said Chief of the Fire Department, and shall have nozzle and stop-cock attached thereto; such hoze shall be of sufficient length to extend thereto; such noze shall be of sufficient length to extend to the furthest limits of such building or place of amuse-ment, and shall at all times be kept in good order and repair, tested once a month under the direction of the Chief of the Fire Department, and filled with water, under pressure, for immediate use, and placed upon automatic reels.

SEC. 4. All buildings used for the purposes aforesaid, with accommodations for one thousand or more persons, shall have at least one stand-pipe in the street or alley on the outside of the building, from ground to roof, with hose attachments, close to a window or door at each floor and gallery.

SEC. 5. All buildings used for the aforesaid purposes shall also be provided with a fire-alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire-alarm, or such other place or places as the Chief of the Fire Department may direct.

SEC. 6. The manager of every theatre, or place of public entertainment, shall employ a man of competency, satisfactory to the Chief of the Fire Department, whose whole duty during performances within such place shall be to take charge of the fire apparatus of such theatre during the performance.

SEC. 7. The cylinders used in the production of calcium light at any theatrical performance within the city of Milwaukee, shall be plainly marked, respectively, oxygen and hydrogen, and the complete exterior surface of the cylinder used for hydrogen, and so marked, shall be the cylinder used for hydrogen, and so marked, shall be painted or colored white, except where lettered, and the complete exterior surface of the cylinder used for oxygen, and so marked, shall be painted or colored black except where lettered. Any manager of any theatre within the city of Milwaukee who shall use, or allow to be used, at any theatrical performance within said city any calcium light, unless the person operating such light shall have a certificate from some competent chemist whose competent certificate from some competent chemist whose competency shall be satisfactory to the Mayor of said city, certifying that such person has been examined by said chemist, and that he is competent to manufacture and use calcium lights.

Any cylinder used for the production of calcium lights shall not be charged with gas or manufactured at the place in which the performance is to be held.

SEC. 8. All ordinances and parts of ordinances in conflict with the provisions of this ordinance are hereby repealed.

TEST OF THE NEW HIGH-SERVICE PUMPING ENGINE AT MILWAUKEE.

G. H. BENZENBERG, City Engineer of Milwaukee, reports to the Board of Public Works that the 24-hour trial run for the purpose of testing the capacity and duty of the two steel tubular boilers and 6,000,000 gallon pumping-engine, furnished by Mr. E. P. Allis for the High-Service Pumping Works, has been satisfactorily completed. His report says:

The conditions of the contract require that the engine and pumps deliver 6,000,000 gallons of water against a pressure of 60 pounds, with a duty of 115,000,000 foot pounds per 100 pounds of coal consumed in the boiler furnaces, without any deductions of whatever kind, and at a steam-pressure not to exceed 80 pounds.

Accordingly an official test was made the coal being

Accordingly an official test was made, the coal being such as is used every day. Records of the counter, steam, receiver, vacuum, suction and force-main gauges, and of the temperature and quantity of the feed-

water, were taken every fifteen minutes during the run, also of the quantity of the coal used and the state of the water in the boilers.

The diameter of the plunger in each pump is 21½ inches and the length of stroke is 3 feet, making the theoretical capacity of each pump 363.05x36+231-56.58, or, for the three pumps, 169.74 gallons. The total number

Total number of pounds of coal consumed......5.075
Total number of pounds of water evaporated.....48,424

Mean temperature of feed-water, 78.44 degrees, giving duty of engine per 100 pounds of coal consumed in the boiler turnaces,

 $100 \times 363.05 \times 3 \times 48.1 \times 38,120 \times 3 = 118,186,312 \text{ foot-}$ 5075 X3=118,180,312 toot-Pounds, which exceeds the contracted duty by over thr

Gas and Electricity.

Illuminating Power of Gas in New York City. New York
Cas-Light
Can-Light
Company.
Manhattan
Cas-Light
Company.
Metropolitan
Company.
Mutual
Cas-Light
Company.
Munc-pal
Gas-Light
Company.
Circkerbocker
Cas-Light
Company.

December 10 24.32 19.55 21.16 28.38 27.60 25.01 31.89

GOVERNOR JOSEPH R. BODWELL

GOVERNOR JOSEPH ROBINSON BODWELL, of Maine, died suddenly on December 15, at his home in Hallowell, Me., of paralysis of the heart. He had been ill for two weeks but his condition was not regarded as serious.

Governor Bodwell was born on June 18, 1818, at Methuen, Mass. While working a farm he took steps that led him into a special business career in which he afterwards became famous. Twenty-five years ago, when capitalists first began to utilize the water-power of the Merrimac, at Lawrence, Mass., Mr. Bodwell was employed to haul granite blocks from Pelham, N. H., for the construction of a dam. In this capacity he became familiar with quarrying and working granite. From this beginning he was remarkably successful, rising from the position of humble employee, with goadstick and oxen. to the head of the granite business in the United States.

So small was the beginning of this granite business that he used to haul the stones out himself with one yoke of oxen. But from this modest commencement eventually sprang into existence the Bodwell Granite Company, probably the leading company of its kind in the country. Of this corporation, and also of the Hallowell Granite Company, Mr. Bodwell was the president, and it is but two years ago that he was reckoned as one of the richest men in the State of Maine.

Mr. Bodwell was elected Governor of Maine on the Republican ticket in September, 1886, and filled various other political positions of trust and honor.

Governor Bodwell was twice married, his second wife being a sister of his first wife.

JOHN C. COCHRANE, architect, of Chicago, Ill., is

PERSONAL.

MR. RUDOLPH HERING has been requested by the City Council of Montgomery, Ala., to examine and report upon the sewerage system proposed for that city by Mr. Williamson, City Engineer.

MR. EDWARD E. MAGOVERN, Jun. Am. Soc. C. E., for several years in the employ of the New York Steam Company as Assistant Engineer in charge of the Division of Steam Supply, has associated himself with Mr. H. W. York, formerly of the United States Revenue Marine Service, and more recently connected with the New York Steam Company, as consulting engineers and experts in steam and mechanical matters, at 22 Cortlandt Street, New York City.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

. OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

GALVESTON, TEX.—The time for receiving plans, etc., for the Sealy Hospital has been extended until January 15, 1888.

ELKTON, KY.—Plans and specifications are wanted here for a school building. Address John O. Street.

JOLIET, ILL.—At a recent meeting of the Common Council the City Clerk was authorized to advertise for plans and specifications for the City Hall and Public Library building to be erected next spring.

ALBANY, N. Y.—Superintendent of Public Instruction Draper has received forty plans and specifications for school-houses, ranging in price from \$600 to \$10,000, in response to the request for modern plans, with a view of adoping those most suitable. No decision will be made as to the successful plans until next month.

TRADE CATALOGUES.

WE have received from The Gurney Hot-Water Heating Co., of 237 Franklin Street, Boston, two well-executed lithographic sheets illustrating the working of The Gurney Hot-Water Heater.



For works for which proposals are requested see also the "Proposal Column," pages i-iv-viii-47.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will jut us in the way of obtaining early and relable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not eisewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

ST. AUGUSTINE, FLA.—It is probable that the Common Council will soon decide upon a definite plan of establishing a sewerage system in this place. Investigations are now being made and a conclusion is expected soon. Mr. G. W. Atwood is at the head of the project.

MACON. GA.—An election is to be held here January 7 to decide the question of issuing \$150,000 in bonds for sewerage, parking and street paving.

LAWRENCE, KAN.—A special committee consisting of Messrs. Hemphill, Stone and Monroe, of the Common Council, have been instructed to confer with some competent engineer as to the estimated cost of construction of a city sewerage.

MOORESTOWN, N. J.—The Moorestown Water Company has not yet succeeded in procuring a water supply for the town. The intention at first was to rely upon a series of wells for the supply, but the scheme was deemed impracticable.

NEW BRIGHTON, Mo —The village authorities of this place offer the East St. Louis Water Company \$500 per year for running water mains through the principal streets and furnishing water-plugs. The water company will probably accept the proposition.

OXFORD, N. C.—Our correspondent writes: "Our town is contemplating water-works by the spring. Mayor T. D. Crawford can give full information."

Springfield, O.—In answer to a request for information in regard to respective extensions in pipe-line here, our correspondent says: "We have contracted for about a mile of 6-inch pipe, which we will lay down in the spring; also, in the near future, expect to make extensions of about three miles in addition to the first named, but we are not yet ready to contract for same."

MONTGOMERY, ALA.—The question of establishing at once an efficient system of sewerage is being agitated and important developments may soon be expected.

Dalton, Ga.—W. II. Murdock writes us from this place as follows: "Some months since an election was held and the majority voted in favor of issuing \$40,000 of 5 per cent. bonds to build water-works. The bonds have not been placed, and nothing done. I am doing all in my power to have artesian wells sunk in sufficient number and capacity to supply the town."

KANSAS CITY, Mo.—Address City Engineer for details of proposed alterations in the Eighth Street Tunnel,

WIARTON, ONT.—Our correspondent writes: "The tender of Mr. John D. Ronalds, of Brussels, Ont., has been accepted, furnishing boiler, 3,400 feet of main iron pipes, 8 hydrants, hose and hose reel. Work to commence as soon as the frost is out of the ground, and to be compl ted and in good running order by the 15th of lune, 1888."

MILWAUKEE, WIS.—The Board of Public Works will expend for sewers \$273,050.

KENTLAND, IND. — Our correspondent writes: "The town of Kentland, Ind., on the 18th of November voted in favor of the erection of water-works and the issuing of the necessary bonds therefor. The Town Board has not taken any further steps in the matter, but will do so soon."

FORT BENTON, MONT.—Concerning water-works matters here our correspondent writes as follows: "Water-works are being put in. Pipes all laid, and engine-house under construction."

DOVER, N. H.—Our correspondent writes: "The citizens of Dover, on November 22, voted in favor of public water-works. It is now in the hands of the city government. Some action will be taken by them, probably this week, to forward the matter."

this week, to scrward the matter."

At a special meeting of the City Council held since, the issuing of \$275,000 of water bonds to provide for the construction of water-works was recommended and the bonds will probably be issued at once.

HILLSBORO, ILL. — Our correspondent writes: "Contract for water-works to be let January 12, 1888. Plans and specifications at clerk's office. W. R. Coats, Engineer. For information address George C. Bryce, City Clerk."

KEY WEST, FLA.—In answer to a question concerning a reported sewerage project for this city our correspondent writes as follows: "We have sent for George E. Waring. Jr., and when he comes he will submit plans, etc."

GRAFTON, W.VA.—Henry S. Wilson. Esq., writes from this place saying: "The town of Grafton has authorized me to make estimates and survey for water-works with the view of putting the same to a vote of the people at next election in March."

DEVIL'S LAKE, DAK.—Our correspondent writes: "The city will, within a short time, have an artesian well bored and would be pleased to hear from any firm in the well-boring business. We want to employ parties that can go 2,000 feet if necessary. The city will pay spot cash for all work contracted."

JERSEY CITY, N. J.—At a recent meeting of the Board of Public Works a sub-committee of the Committee of One Hundred of the Citizens' Association submitted a report on the water question. The report opposed the changing of the present water-supply, which it claimed was almost as good as Croton water. It advised the board not to enter into a contract with any private corporation. The report was filed.

DAYTON, KY.— This place is to have a system of water-works. A representative of the Mercer Water Co., of New York City, is to make an estimate of the number of miles of water-pipes to be used, and the cost of putting up the plant, and the probable amount of revenue to be derived; then a proposition will be made to Council accordingly. City Clerk Haywood can give information.

MOUNT STERLING, KY.—The water-works question is being agitated here.

BROOKSVILLE, FLA.—An artesian well is to be sunk here.

The second secon

SHELDON, ILL.—O. Ott can give details of a proposed system of water-works for this town. It is said that the works are to be erected by the Illinois Central Railroad Co.

WEST BRANCH, MICH.—Water-works will probably be established in this place.

FAIRHAVEN, MASS.—Joseph K. Nye can give information concerning a \$50,000 waterworks project for this place.

LEBANON, PA.—Additional mains are to be laid here, and the water-works system is also to be extended.

Missouri Valley, Iowa.—Our correspondent writes from here as follows: "There has been nothing done since my last letter except to appoint committees to investigate systems, etc."

ALTON, Mo.—Concerning a report that water-works were to be established here our correspondent writes as follows: "No water-works contemplated in this town."

Springfield, O.—Bids will soon be wanted here for 5,310 feet of water-pipe.

FERNANDINA, FLA.—This city has decided, by popular vote, to bond itself for waterworks, and important developments may be expected soon.

EUFAULA, ALA.—In reference to water-works matters here our correspondent writes: "The water-works are now being constructed, the stand-pipe being complete, and the mains are now being placed, and we expect them to be in successful operation by or before February, 1888. The contract was awarded to William D. Chapin and associates of Montgomery, Ala."

SANDWICH, MASS.—Concerning a reported water-works project here our correspondent writes as follows: "We apply to the Legislature this winter for a charter."

ACUSHNET, MASS.—This place is to be supplied with water from the New Bedford, Mass., water-works system. The work will not be begun until spring, though most of the pipe is to be purchased at once. About \$20,000 will be expended.

BRIDGES.

DUBLIN, GA.—On December 21 l aurens County will decide by vote whether or not to issue bonds in the sum of \$15,000 to place bridge over the Oconee River.

BROCKPORT, N. Y.—A small bridge is to be erected here.

HICKMAN, KY.—It is reported that a levee is to be built from this place to Tiptonville, a distance of about fourteen miles, at a cost of \$110,000.

WHEELING, W. VA.—Concerning a report that several bridges were to be erected here, our correspondent writes: "No positive action has been taken. Mr. Linch, acting for a Mr. Clarke, made a proposition which our board refused to accept. I'roposition was to give Clarke five years to build, and board would only give three, and subscribe \$300,000 to the capital stock of same."

BUFFALO, N.Y.—Our correspondent writes: "A bridge is to be built over Scajaquado Creek. Plans are ordered. Nothing further will be done until next year."

BRIDGEPORT, CONN.—The contract for the erection of the new lower bridge has been awarded to Dean & Westbrook, of New York, who represent the bridge building company, with works at Phœnixville, Pa. The contract price is \$67.500. The work of building the bridge will be commenced early next spring.

JACKSON, N. H.—The County Commissioners will build a bridge here.

GRAND FORKS, DAK.—A \$50,000 bridge will be erected here.

CAMDEN, S. C.—A bridge over the Catawba River is to be erected by the County Commissioners.

TAINTER, WIS .- A bridge is to be built

SELKIRK, MAN.—A bridge is to be erected here, over the Red River.

SANDLAKE, N. Y.—The town will build several bridges.

COLDEN, N. Y.—An iron bridge is to be constructed in this city.

GAS AND ELECTRIC-LIGHTING.

New Brunswick, N. J.—There is talk of starting an electric lighting plant here.

Union City, Tenn.—The question of electric lights is being agitated.

THE Roodhouse Electric and Power Company, Roodhouse, Ill., has been incorporated. Capital stock, \$5 000. Ellis Briggs and others, incorporators.

HOLLAND, MICH.—It is reported that this place will establish an electric-light plant.

EXETER, N. H.—Electric-lights are to take the place of gas here.

CHEYENNE, W. T.—This city is to have a Fahwehjelm incandescent gas-light plant, similar to the one in use in Chicago, 1!1.

NEW LEXINGTON, O.—A new electric-light company will establish a plant here.

MONTGOMERY. ALA.—The City Council has closed a contract with the Brush Electric-Light Company, of this city, to light the publics streets for a term of five years with 100 2,000 candle-power lights, at an annual cost of \$15,512.50.

HARTFORD. CONN.—The question of lighting the streets of this city with electricity is receiving the attention of the officials.

WILLIAMSPORT, PA.—Our correspondent says: "The contract for lighting the city with electric lights has been let to the Edison Arc-Light Co., of this city. Work will be commenced immediately after a decision is given by the City Solicitor in reference to the legality of act of Councils in letting the same by resolution, instead of by ordinance—the Lower Branch having let the same by ordinance to the Fort Wayne Jenny Electric-Light Company, and the Select Branch adding thereto a resolution giving it to the home Company."

NEVADA CITY, NEV.—A project is on foot to erect an electric-light tower 100 feet high at the Court-House in this place, from which four lamps of 2,000 candle-power each will be suspended.

STILLWATER, MINN.—A natural-gas shaft is to be sunk here.

SIOUX CITY, 10WA.—The Sioux City Light, Heat and Power Co. has been incorporated. Capital, \$100,000. Emerson McMillin, L. L. Kellogg, and others, incorporators.

LOUISVILLE, KY.—The Louisville Electric-Light Co. will make improvements to its plant.

RAILROADS, CANALS, ETC.

BIRMINGHAM, ALA.—A railroad tunnel under street crossing is to be built here. Address W. H. Hughes.

OAKLAND, CAL.—Walter Blair, Samuel Howe, and others are at the head of the Broadway, Berkeley and Piedmont Railway Co., to operate a street railway here. Eight miles of road will be built and over \$500,000 will be expended.

EL PASO, TEX.—A. M. Loomis can give details of proposed street railroad for this city.

ONEONTA, N. Y.—Address Alfred Morris for details of proposed street railway; \$20,000 is invested and to be used.

FLUSHING, N. Y.—Surveyors have begun operations on the street-car railroad which is to be established here. At the conclusion of their work it is probable that contracts will be let for the construction of the road. About ten miles of tracks are to be laid. For particulars address Supervisor Joseph Dykes, President Flushing and College Point Railway.



LITTLE ROCK, ARK.—Our correspondent writes: "A charter has been granted to the City Electric Railway Company to build and operate lines over several miles of streets in this city and suburbs. They propose to operate ordinary street railway cars and also a dummy line for the transfer of freight as well as passengers. Work will probably be commenced in January, 1888, and at least one mile built the coming spring. F. J. H. Rickon is engineer for the company."

BIDS OPENED.

ST. LOUIS, Mo.—Synopsis of bids for 300 tons cast-iron coated water-pipe, opened in this city December 5 by the Board of Public Improvements:

	8c tons re-inch water-pipe 19o tons re-inch water-pipe 25 tons 6-inch water-pipe		Quantities.		
	\$30.85 30.85 30.85	Price.			
\$9,255.00	\$2,622.25 5,861.50 771.25	Amount.	R. D. Wood & Co.		
	40		\$29.95 29.95 29.95		
\$8,985.00	\$2,<45.75 5,690.50 748.75	Amount.	Shickle, Harrison & Howard Iron Co.		
	\$36.70 36.70	Price.			
\$11,010.00	\$1,119.50 6,973.00 917.50	Amount.	Cincinnati and Newport Iron and Pipe Co.		

The contrict was awarded to the Shickle-Harrison & Howard Iron Co.

MILWAUKEE, WIS.—The Board of Public Works opened bids December 8 for constructing the flushing-tunnel. It will be 2,400 teet long and 12 feet in diameter. The contract will amount to about \$113,000:

Bidders.	Price per cubic yard for rock excavation.	Price per lineal foot for tunnel and gate shafts.
Ross & Onderdonk, New York W. T. Casgrain John O'Neill	\$8.00 7.00	\$68.00 59.50 57.00
John Angus, Ch.cago	16.75 3.00 12.00	55.00 48.50 47.25

The contract was let, on December 9, to William Forrestal, of Milwaukee. The tunnel will take 3,000,000 bricks and 12,000 barrels

PITTSBURG, PA.—No bids were received by Controller E S. Morrow for a mud-drum and stand-pipe, advertised to be opened Decem-

New Lexington, O.—The contract for the steam-heating apparatus, plumbing, and gas-fitting, with the iron-work, drainage, stone, wood and brick work, etc., etc., con-nected therewith, of the new court-house here, has been awarded by the Commissioners to Kelly & Co., of Columbus, O., at the sum of \$8,140.

ELIZABETH, N. J.—The Committee of the ELIZABETH, N. J.—I he Committee of the Common Council has awarded the contract for lighting the streets of this place to the New York and New Jersey Globe Gas-Light Co. for a term of one year at a cost of \$17 per lamp, the city reserving the right to cut off 100 lamps and substitute electricity at any time.

DULUTH. MINN. -- Council has granted franchise to the Electric-Light Company for ten years to furnish 100 20-candle-power lights at \$17.50 per light per year. The plant will be put in at once.

PHILADELPHIA, PA.—At the Gas Bureau bids for supplies for the ensuing year, exclusive of coal, which were opened last week, were opened on December 13. Bids had been were opened on December 13. Bids had been requested for about 7,000 gas-meters, varying in quantities from three lights to 300 lights each, and letters were received from the following firms: American Meter Co., the Goodwin Gas-Stove and Meter Co, and Helme & McIlhenny, who stated that they collectively would furnish meters at the following forms. collectively would furnish meters at the fol-

lowing prices:
Three-light meters, \$5.50 each; 5-light, \$7 each; 10-light, \$9; 20-light, \$12; 30-light, \$16; 45-light, \$23; 60-light, \$33; 100-light, \$55; 150-light, \$85; 200-light, \$120; and 300-light, \$205 each.

light, \$205 each.

This is a very great increase over the bids of last year, when the prices were: \$4.10, \$5.20, \$6.50, \$9, \$12.25, \$18, \$24.50, \$39, \$63, \$83, and \$150 respectively.

Director Wagner refused to award the contract, because of the apparent combination, and he declared he would readvertise for bids.

BOSTON, MASS. - Synopsis of bids for 420, BOSTON, MASS.—Synopsis of bids for 420,-000 feet, b. m., of kyanized spruce plank for Harvard Bridge, opened 1 ecember 10 by the Bridge Commissioners: W. S. Barker \$24,39 per 1,000 feet; A. M. Stitson & Co., \$26 50 per 1,000 feet. The contract was awarded to the lowest bidder.

MILWAUKEE, Wis.—Synopsis of bids for furnishing the House of Correction with 1,045,000 feet of hard-wood lumber. Cameron Bros.' bid of \$15,569.50 being the lowest will probably be accepted by the County Board. The other bidders were: C. H. Grenlich Bros. and J. H. McCarthy.

ISHPEMING, MICH.—The contract for build-ISHPEMING, MICH.—The contract for building the ore docks at Marquette and St. Ignace has been let to Thomas H. Hamilton of Toledo. Three docks at Marquette have a capacity of 18,000 tons, which will be increased to 33,000 tons. Additional docks at St. Ignace will hold 10,000 tons. The price is not made public, but it is said to be the largest single contract of the kind ever let. New docks will be built by the opening of navigation next spring.

HAMMOND, IND.—Synopsis of bids for construction of a system of water-works, opened December 12 by the City Trustees:

E. B. Wingate, Chrcago, III	Bidders.
\$4.125.00	Pump-house, chimney, and reservoir.
\$3,271.00 4,450.00 4,500.00	Pumps and boilers.
	Stand-pipe.
\$4,301.80 \$11,697.80 5,778.00 12,960.00 5,200.00 9,700.00	Total.

Contract awarded E. B. Wingate.

WINONA, MINN .- Council has awarded firealarm system contract to Gamewell Electric Light Co., for \$4 300, work to be done under the supervision of the City Engineer.

COLUMBUS, O.—The bids opened recently for the new water works engine ranged from \$56,000 to \$90,000.

ROSEDALE, KAN .- The Kansas City Bridge and Iron Company has been awarded the contract to construct a bridge here, to cost **\$33,440**.

POWHATAN, ARK. — Our correspondent writes: "The following named architects presented plans, etc., in competiton for the new Court-House to be erected here: C. G. Rosenplanter, Memphis, Tenn.; Orlopp & Kusener, Little Rock, Ark.; B. J. Bartlett, Little Rock, Ark.; A. Weiczorek, Little Rock, Ark.; D. A. McKinnda, Paducah, Ky. Those prepared by the last-named gentleman were accepted and adopted."

It is reported that Secretary Endicott has settled the controversy which has arisen in regard to the work of excavating the Harlem regard to the work of excavating the rather ship Canal, by awarding the contract for that work to John Satterlee, of Englewood, N. J., at his bid of 93 cents per cubic yard for material above water. and \$1.13 per cubic yard for material under water. The appropriation for this work amounts to \$400,000.

BOSTON, MASS.—The bids for furnishing and erecting the iron superstructure of 23 spans of the Harvard Bridge across the Charles River between Boston and Cambridge were opened December 11, and are as follows:

King Iron Bridge and Manufacturing Co., Cleveland, O., Item A, \$153,900; Item B,

4.4c. per lb.

Keystone Bridge Co., Pittsburg, Pa., \$156,-

500; 4.6c. per lb.

Boston Bridge Works, Boston, Mass., \$161,-900; 4.7c. per lb.

Union Bridge Co., New York, \$161,980;

43/c. per lb. Cofrode & Saylor, Philadelphia, Pa., \$164,-

000; 42/3c. per lb.

New Jersey Steel and Iron Co., Trenton,

V. G. Coolidge & Co., Chicago, Ill., \$179,-

990; 5.3c per lb.
Edge Moor Iron Co., Wilmington, Del.,

\$179,000; 5.87c. per lb.
Berlin Iron Bridge Co., East Berlin, Conn.,
\$183,790; 5\%c. per lb.
Smith Bridge Co., Toledo, O., \$190,000;

4.97c. per lb.
Groton Bridge Co., Groton, N. Y., \$189,000;

5½c per lb.
Wrought Iron Bridge Co., Canton, O.,

\$193,020; 5.3c. per lb.
Atlantic Works, Boston, Mass., \$198.000;

Attainte Works, Boston, Mass., \$130.000, 534c. per lb.

Item A includes spans I, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13. 14, 15, 16, 17, 18, 19, 20 and 21, and the cantilever portions of spans II, 12 and 22.

Item B includes span 23 and all but the

and all but the cantilever portions of spans 11, 12 and 22.

Although the King Iron Bridge Company was the lowest bidders, the Commissioners, consisting of Mayor O'Brien, of Boston, Mayor Russell and Mr. Leander Greeley, of Cambridge, decided that in view of the expense of inspecting the work of the King Iron Bridge Company, at Cleveland, O., and in consideration of the foat that Boston and Combridge Company, at Cleveland, O., and in consideration of the fact that Boston and Cambridge mechanics would be benefited if the Boston Bridge Company was awarded the contract; the Commissioners agreed to award the contract to the Boston Bridge Company. The Commission on the Harvard Bridge was a special one, appointed by the Massachusetts Legislature, for the purpose of building a bridge between Cambridge and Boston, and it had a right to make any decision that a mabridge between Cambridge and Boston, and it had a right to make any decision that a majority of the Commissioners might agree to; if, however, the bridge had been exclusively within the control of the city of Boston, under existing ordinances, the city would have been obliged to award the contract to the lowest bidder, providing he had furnished a satisfactory bond. It is expected, but not guaranteed, that at least one-half the masonry piers of the bridge will be completed by September 1, 1888, and the balance by November 1, 1888. The iron contractor agrees to complete his work by December 1, 1888, but that time may be extended.

NEW YORK CITY.—The Aqueduct Commissioners have announced that the award of the work of constructing the Sodom dam and reservoir has been postponed until Monday, December 19.

SANTA FE, N. M.—Synopsis of bids for SANTA FE, N. M.—Synopsis of Dids for the completion of the Federal building in this city opened December 8: Ha.lack Lumber Company, Denver, Col., and Cavanagh & Hill, Las Vegas, each, \$37,000; Berardenelli & Hallidino, Santa Fe, \$33,800.

PHILADELPHIA, PA.—Synopsis of bids for supplies for the Gas Department opened De-

cember 13 by the Gas Bureau:
For 200 lengths of 2-inch cast iron pipe and titings and connections: Gloucester Iron Works, 12c. per foot for pipe and 3½c. per pound for fittings; Camden Iron Works, 12c. per foot and 2¾c. per pound; Mellert Foundry and Machine Co., 16c. per foot and 3½c.

per pound for fittings.

For 3.000 lengths 3-inch cast-iron pipe the bids of the same firms were: 200., 17,70c. and 22c. per foot for pipe, and 3c., 23/c., and 3c.

per pound for fittings.

For 100 lengths of 8-inch the same firms bid: 52, 59, and 60 cents per foot for pipe, and 2.47, 2½, and 2¾ cents for fittings, and Donaldson Iron Co. bid 50, 6c. per toot for pipe and 2.48c. per pound for fittings.

For 50 lengths 12-inch pipe the bids were 94, 95.2 cents, \$1.07, and Donaldson Iron Co., 93½ cents per foot, and 2.47, 2½, 2¼, and

2.48 cents per pound for fitting.
For 50 lengths 20 inch pipe the bids were:

For 50 lengths 20 inch pipe the bids were: \$1.81, \$1.86, \$1.90 for pipe, and 2.47, 2\frac{7}{2}, and 2\frac{7}{2} cents per pound for the Gloucester and Camden & Mellert Co.s, and I. S. Cassin & Co. and S. J. Cresswell. 2\frac{7}{2} and 2.65 cents per pound respectively for castings.

For 635 lengths of 20-inch cast-iron pipe and fittings the bids were: Mellert Foundry and Machine Co., \$1.90 per foot and 2\frac{7}{2}c. per pound for castings; Camden Iron Works, \$1.86 per foot for pipe and 2\frac{7}{2}c. per pound for fittings; McNeal Pipe and Foundry Co., \$1.94 per foot and 2\frac{3}{2}c. per pound; Gloucester Iron Works, \$1.88 per foot and 2.47c. per pound.

per pound.

For 542 lengths of 12-inch pipe the bids were: Donaldson Iron Co., 94.73c. per foot; Mellert Foundry and Machine Co., \$1.07 per

were: Donaldson Iron Co., 94.73c. per foot; Mellert Foundry and Machine Co., \$1.07 per foot for pipe, and 23/c. per pound for castings; Camden Iron Works, 95.02c. per foot and 21/c. per pound; Gloucester Iron Works, 98c. per foot and 2.47c. for castings; McNeal Pipe Co.. \$1.01 per foot and 23/c. per pound. For 284 lengths 8-inch pipe: Donaldson Iron Co. bid 51.03c. per foot for pipe and 23/c. per pound for httings; Mellert Foundry and Machine Co., 60c. per foot for pipe and 23/c. per pound for fittings; Camden Iron Works, 59c. per foot for pipe and 23/c. per pound for castings; Gloucester Iron Works, 54c., pipe, and 4.47c., fittings; McNeal Pipe Co., 58.03, pipe, and 23/c., fittings. For the castings of the last lot, I. S. Cassin & Co. bid 21/3c. per pound for the 20 and 12 inch castings and 21/c. for the 8 inch ones.

For the brass supplies, Charles Perkes, 627 Arch Street, was the only bidder. For 400 retort mouth pieces and lids, Green's patent, the only bidder was James R. Floyd, at \$28.65 each.

\$28.65 each.
For two-cylinder 30 inch boilers, 20 feet long, Sidebotham & Powell bid \$345, and for two 50 horse power horizontal tubular boilers, the same firm bid \$1,195 I. P. Morris bid

GOVERNMENT WORK.

GOVERNMENT WORK.

CARSON CITY, NEV.—Synopsis of bids for material to erect, ready for interior finish, the Court House, opened December 10 by the Supervising Architect of the Treasury Department: James H. Coster, \$83,901.25; James B. Haliday, \$82,087, native sandstone; \$87,000, Fort Scott red sandstone; E. R. Brainard, \$92,250; E. T. Gobel, \$89,500; \$66,375, omitting all pressed and molded brick and substituting Carson City common brick, stained and painted, and omitting granite and brownstone and substituting Bedford limestone.

KEY WEST, FLA.—Synopsis of bids for general excavation and filling for Custom-House and Post Office, opened December 14 by the Supervising Architect of the Treasury Department: Collin McKay Grant, \$14,400; William D. Campbell, \$21,720, additional for reasoned piles \$6,000 creosoted piles, \$6,000.

BELFAST, ME -Synopsis of bids for materials for plumbing at the Custom-House opened December 8 by the Supervising Architect of the Treasury Department: J. T. Pottle, \$1,173.

MISCELLANEOUS.

Brenham, Tenn.—The Mayor can give information concerning a fire-alarm system wanted for this place.

PIIILADELPHIA, PA.—The Vessel Owners' and Captains' Association has endorsed the movement for the improvement of Delaware Harcor by the removal of Smith's and Wind Mill Island and has appointed a committee to consider plans for the removal if feasible.

NEW INCORPORATIONS

THE Little Phoenix Manufacturing Company, Chicago, Ill.; capital stock, \$50,000. George R. Walker, and others, incorporators.

THE Chicago Differential Electric Company, Chicago. Ill.; capital stock, \$200,000. John Wallace, and others incorporators.

THE Ames Manufacturing Company, Chicago, Ill.; capital stock, \$200,000. Ames, and others, incorporators. Wilson

THE Chenoweth Conduit Company, Rahway, N. J.; capital stock, \$200,000. John Weaver, and others, incorporators.

THE New England Gas-Lighting Company Portland, Me.; capital, \$500,000; Nathanie H. Shaw and others.



PROPOSALS.

(Continued from page visi.)

CAST-IRON WATER-PIPE AND SPECIAL CASTINGS.—S aled proposals will be received at the office of the Board of Water Commissioners of the city of st. Paul. Minn., until December 20, for furnishing said city with the following, in accordance with the plans and specifications on file in the office of said water board.

plans and specifications on file in the office of said water board.

11,525 lineal feet of four (4)-inch pipe, with the privilege of 2,000 feet additional
68,355 lineal feet of six (6)-inch pipe, with the privilege of 15,000 feet additional.
21,085 lineal feet of twelve (12)-inch pipe, with the privilege of 2,000 feet additional.
3,750 lineal feet of sixteen (16)-inch pipe, with the privilege of 500 feet additional.
16,125 lineal feet of twenty (20)-inch pipe, with the privilege of 500 feet additional.
1,230 lineal feet of twenty-four (24)-inch pipe, with the privilege of too feet additional.
1,530 lineal feet of twenty-four (24)-inch pipe, with the privilege of 50 feet additional.
Special castings. 125 tons, with the privilege of chough to lay above pipe.
Bids must be indorsed, "proposals for cast-iron pipe and specials," and addressed to the undersigned.

John Caulfield, Secretary Board of Water Commissioners.

HARBOR WORK.—Proposals are wanted at Washington, D. C., until January 3, for the improvement of the liarbor of Pernambuco. Address J. August P. d. Costa, Charge d'Affairs of Braz 1, at the Brazilian Legation, Washington, D. C., or at the Brazilian Consulate General, New York City.

PAVING.—Proposals are wanted at Danbury Conn., or paving certain streets with granite. Until Decemfor paving certain streets with granite. Unt ber 28. Address Chas. H. Wilcox, Warden.

WATER WORKS.—Proposals are want-d at Gal-weston, Texas, until Jai uary 16, for furnishing mat-erials and constructing Water Works according to prepared plans. Address Albert Weis, Water Works Commissioner, Galveston, Texas.

DESIGN FOR SOLDIERS' MONUMENT.— Valentine Clowes, 130 Fulton Street, Hempstead, L. I., wants artists and others to present to him ap-propriate designs for a soldiers' monument, to be set up in the e-metery in that village. The competition will end Dec. 20.

MUNICIPAL BUILDINGS—Proposals are wanted at Toronto, Can., unvil Jan. 2, for Municipal Buildings. Address John Jones, Chairman Court-House Committee, City Hill.

IRON PIPES, CASTINGS - Proposals are wanted at Albany, N. Y., until January 3, for furnishing a quantity of 110n pipe. Addresa A. Van Deweer, President, Special Water Commission.

PUMPING ENGINES.—Bids will be opened by the Board of Public Works of Milwaukee on Dec. 22 for Pumping Engines for the new flushing tunnel.

WATER PIPE.—Proposals are wanted at Milwau-kee, Wis., for 2000 tons water pipe; no date specified. Address S. H. Benzenberg.

FIRE HYDRANTS.—Proposals are wanted a Milwaukee for 100 fire-hydrants; no date specified. Address S. H. Benzenberg.

COURT-HOUSE.—Proposals are wanted at Eure-ka, Cal., until January o, for the construction of the fourth section of the Court-House in that city. Ad-dress J. F. Coonan, County Clerk.

COLLEGE BUILDING.—Proposals wanted at Arkadelphia, Ark., for building colleges. Until December 20. Address J. C. Saunders.

COURT HOUSE.—Proposals wanted at Lincoln, Nebraska. Until January 3. Address O. C. Bell, County Clerk.

IRON FITTINGS.—Proposals are wanted at Milwaukee, Wis, for iron fittings for county jail. Address Frederick Wilkins, County Clerk.

LIMESTONE, ETC.—Proposals wanted for 1,000 tons of limestone and 200 tons of svenite, at Ottawa, Ontario. No date specified. Address City Engineer.

WATER WORKS.—Proposals are wanted at Hills-boro, Ill., until January 12, 1888, for a complete system of water-works. Address Geo. C. Bryce, City Clerk.

SAW MILL MACHINERY.—Proposals are wanted at Darlington, I. T, until December 27, for saw mill machinery, according to specificat ons in the hands of Gilbert D. Williams, U. S. Indian agent.

PAVING, ETC. — Proposals are wanted at Toronto, Canada, until December 20, for paving and other street work. Address W. H. Cariyle, Chairman Committee on Public Works.

BRIDGES.—Proposals are wanted at Nashville, Tenn., until Dec. 28, for building bridge acr ss the Stone River, at Stewart's Ferry. Address John Over-ton, Nashville, Tenn.

CAST-IRON PIPE.—Proposals are wanted at Manchester, N. H., until January 2, for a quantity of cast-iron pipe. Address Charles K. Walker. Superintend-ent Water-Works.

BUILDING PIER.—Proposals are wanted at New York C ty, until December 22, for removing old pier and building a new one, at the foot of Franklin Street, North River. Address Department of Docks, Pier 1, N. R.

WATER-GATES.—Proposals are wanted at St. Paul, Minn., until December 28, for the following water-gates: 10 2-inch, with the privilege of 5 additional; 25 6-inch, with the privilege of 50 additional; 12 56-inch, with the privilege of 5 additional; 2 16-inch, with the privilege of 5 additional; 2 16-inch, with the privilege of 3 additional; 16 20-inch, with the privilege of 2 additional; 2 24-inch, with the privilege of 2 additional; 2 36-inch, with the privilege of 7 additional; 2 36-inch, with the privilege of 7 additional. Address John Caulfield, Secretary Board of Water Commissioners.

SEWERS AND STREET-WORK. -Proposals are wanted at New York City, until December 28, for laying sewers in certain streets; also, other streetwork. Address Department of Public Works.

PLUMBING.—Proposals will be received at the office of Will A. Freret, Supervising Architect, Washington, D. C., until December 20, for the labor and materials for plumbing, etc., for the sanitary improvement of the United States Treasury Building.

MASONRY.- Proposals are wanted by Thomas C. Veale, of Athens, Tenn., until December 20, for the stone masonry of a hotel.

CHOOL BUILDING .- Proposals are wanted at Baltimore, Md., until December 21, for the erection of the Colored High and Grammar School building. Ad-dress J. Theo. Oster, Inspector of Buildings.

BRIDGE.—Proposals are wanted until February for building a bridge over the Heuse River, in Craven County, N. C. Address the Register of Deeds, New Berne, N. C.

WATER-WORKS. — Proposals for a system of rater-works are wanted at Hoopeston, Ili.

STEAM-HEATING, ETC.—Proposals are wanted at Brooklyn, N. Y., until December 22, for improvements to steam-heating and ventilating apparatus at insane asylum. Address F. B. Cadly, Clerk for Kings County Supervisors, Brooklyn, N. Y.

PUMPING MACHINERY.—Proposals are wanted at Milwaukee, Wis., unt'l December 22, for constructing, delivering, and erecting, etc., suitable pumping-machinery for the Milwaukee River Flushing Tunnel, according to specifications; also steam-engine and boilers. Address G. W. Porth, Comptroller.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart Abouse, apart nent-house: ten, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

S s 127th, 100 w 8th av, br flat; cost, \$18,-000; o, John W Haaren; a, John C Burne.

225-229 E 43d. 3 br flats; cost. \$66,000 all; o, M Mahond & E Coyne, a, Herter Bros.

123 Baxter, br flats; cost, \$20,000; o, August Ruff; a, Kutzer & Rohle.

26 Henry, br flat; cost, \$16,000; o, Harris Silberman; a, J Boekel & Son.

N w cor Southern Boulevard and 177th st. 2 fr dwells; cost, \$7,000; o, F A Kerker; a, I H Valentine.

N w cor 4th av and 110th, 4 br flats; cost. \$80,000 all; o, Peter F Mallon; a, Geo C Baggs.

S s 125th, 80 e 5th av, 3 br flats and stores; cost, \$100,000 all; o, Adolph Kert; a, D & J Jardine.

S w cor Wilson av and 137th, fr dwell; cost, \$13,000; o, Robt Hall; a, F Finty.

34 Hudson, br dwell and store; cost, \$15,-000; o, H C West; a, J C Babcock.

ALTERATIONS-NEW YORK.

329-331 Broadway, construct elevator shaft of iron and terra cotta, with skylight on top; cost, \$7,000; trustee, J L Barclay; m, George Vassar & Son.

BROOKLYN.

Ewen, e s, 25 s Montrose av, br st and dwell; cost, \$8,000; o, Sebastian Missig; a, F I Berlenbach.

12% 3d av, br store, offices, lodge room; cost, \$20,000; o, E P Day; a, Louis A Hoo-

N s Nassau av, 25 e Monitor st, 5 fr dwells; cost all, \$12,000; o and a, Samuel Sief

Sw cor 3d av and 46th st, br store and dwell; cost, \$7,000; o, Catherine Mickel; a, not given

169-71 Troutman st. 2 fr tens; cost all, \$9,. 000; o, John Jung; a, Th Engelhardt

S w cor Prospect st and Flushing av, dwells and stores; cost all, \$12,000; o, Chas. Rissler; a, H Vollweiler

N s De Kalb av, 150 w Stuyvesant av, 4 r dwells and stores; cost all, \$28,000; o, Mrs S W Post; a, same as above

W s De Kalb av, 100 w Stuvvesant av br dwells and stores; cost all, \$14,000; o, J F Sullivan; a, same as above

N s 50th st, 100 w 3d av, 11 fr dwells; cost all, \$24,200; o, John H O' Rourke; a, W H

S s Halsey st, 25 e Ralph av, 9 br dwells; cost all, \$49,500; o, Walter Hopkins; a,David Acker & Son

N s Van Buren st, 100 e Lewis av, 5 brick dwells; cost all, \$25,000; o, Sam'l R Walters; a, I D Reynolds

W's 6th av, 20 s 5th st, 10 br dwells; cost all, \$30,000; o, Thomas Butler; a, W. H. Wirth

BUILDING INTELLIGENCE.

N s Prospect av, 370 e 7th av, 3 fr dwells; cost all, \$9,000; o and a, S M Fickett

Es 1st st, 80 n Grand st, br warehouse store; cost, \$14,500; o, C H Tiebout; a, W. Wheeler Smith

N s Prospect av, 205 e 7th av 5 fr dwells; cost all, \$15,000; o and a, S M Fickett

Dodworth st. n s, 200 e Broadway, br cork factory; cost, \$30,000; o and a, S A Padd-

ALTERATIONS-BROOKLYN.

Brooklyn av, s w cor Fulton, add on story, also br extension; cost, \$8,000; o, J F Hendrickson; a, I D Reynolds.

38-44 Ross st, br flat; cost, \$10,000; o, Peter and Jas Young

CHATTANOOGA, TENN.—Montgomery av. school-house, brick, stone trimmings, slate, plain floors; cost, \$18.000; o, city of Chattanooga; a, R Hunt; b, M I Eastman.

PHILADELPHIA, PA.—Director Wagner has prepared plans for the erection of a large new gas-holder at the Fifteenth Ward works, and bids for the construction thereof will shortly be asked.

ASHLAND, WIS .- A \$50,000 mining machinery manufacturing plant will be put in.
John McCann, of Bessemer, is interested.

BOSTON, MASS.—Washington and Devonshire, offices for newspaper purposes; cost, \$160,000; o, C U Cutting, trustee; a, Bradlee, Winslow & Wetherell; b, T E Bradlee, Win Stuart & Co.

Rogers av, near Ruggles st. locomotive house: cost, \$40,000; o, B & P R R Co; a, Geo F Folsom; b, David Connery & Co.

455-457 Beacon, 2 br dwells; cost, \$22,-000; o, A H Caton; a, J H Besarick; b, owner.

233 Commonwealth av, brick dwell; cost, \$50,0 0; 0, Wm C Rogers; a, Rotch & Tilden; b, Geo G Nichols.

441 Beacon, br dwell; cost, \$20,000; o, Alden Avery, a, Geo A Avery; b, owner.

408 Beacon, ebr dwell; cost, \$25,000; o. Dr B M Hodges; a, Allen & Kennedy; b, David Connery & Co.

369 Beacon, br dwell; cost, \$20,000; o, Alden Avery, a, Geo A Avery; b, owner.

410 Beacon, br dwell; cost, \$22,000; o, T Burr, Jr; a, Cabot & Chandler; b, Chas A Dodge.

20 Gloucester, br dwell; cost. \$75,000; Mrs C F Adams; a. Peabody & Stearns; b, Woodbury & Leighton.

266 Beacon, br dwell; cost, \$45,000; o, liza B Skinner; a, Shaw & Hunnewell; b, L D Wolcott.

18-26 Columbus av, brick stores; cost, 8,000; o, Wm Prescott; a. Alden Frank; b. Geo Nowell.

WASHINGTON, D. C .- 152-54 D st, 325 2d st, S E, 3 3-story br bldgs; cost, \$14,-200; o, Walters & Meigs; a, G B Phelps; b, W E Keefer

208-16 F st, N E, 5 2-story brick bldgs; cost, \$7,500; o, J W Phillips; a, W W Danenhower

Takorna Park, 3-story fr bldg; cost, 10,000; o, Henry Cady; a, Leon Dessey; b, Henry Cady

1436 Mass av, 3-story br bldg; cost,\$12,-000; o, K Crissey; a, H E Page; b, Burgoyne 1438 Mass av.

1438 Mass av, 3-story br bldg; cost, \$11,500; o, H Dunlap; a and b, same as

436-42 3d st, 4 2-story br bldgs; cost, \$8,000; o, W C Durall; a, J T Crismond 35 less than \$7,000 in value

KANSAS CITY.—No bldgs costing \$7,000 and over this week. 103 costing less than \$7,000

ST PAUL, MINN.—Exchange, nr St Peter, story br school; cost, \$25,000; o, Church of the Assumption

PHILADELPHIA.—Calvert, bel Orchard, dye house; b, Chas W Platt

Lancaster av, w 39th, br office bldg; Wartman Grau, contractor

8th and Whitney 4-story br store and dwell; b, L I Hurst

20 dwells less than \$7,000 each

BUILDING INTELLIGENCE.

COUNCIL BLUFFS, IOWA.—The Nonpa reil will erect a \$100,000 building.

TATE SPRINGS, TENN .- Address Mr. Thomilson for details of large hotel which he proposes to erect.

INDEPENDENCE, MO .- It is reported that a \$100,000 hotel will be built here.

JANESVILLE, WIS .- Engineers are surveying for a water-power four miles south of Janesville. A 600-loom cotton mill will be built by Eastern capitalists.

GRAND RAPIDS, MICH.—A public building is to be built by the Kent County Board of Supervisors, at a cost of \$200,000.

The city will erect a large fire and police station to cost about \$20,000.

ST. JOSEPH, MO .- A central station will be erected in this city for the police and fire departments. The building will be fitted with all modern improvements and cost about \$25,000.

LITTLE ROCK, ARK.—A \$50,000 Masonic Temple will be erected in this city.

EAU CLAIRE, WIS .- The Y. M. C. A. is to erect a building to cost \$40,000. It will have a theatre, gymnasium, bath-room, etc.

WORCESTER, MASS. - Nothing over \$7,000 in value to report this week.

PROVIDENCE, R. I.—Anthony av, n s, 4 fr dwells; cost, \$8,000; o and a, R A Gladding.

9 permits for less than \$7,000.

BUFFALO, N. Y.—Plans for buildings amounting to \$14,500 have been filed this week.

ROCKVILLE, CONN. — Cor Park and School, br and stone town hall and memorial hall; cost. \$70,000; a. Richmond & Seabury, Springfield, Mass; b, contract not let.

MILWAUKEE, WIS.—Garfield av, br ven church; cost, \$17,000; o, German Methodist Episcopal Society; b, Riesen Bros.

Milwaukee, br dwell; cost, \$7,000; o. Wm Thwaits.

A Meinecke's new house on Milwaukee st will cost \$12,000 instead of \$10,000 as reported last week.

6th, br dwell; cost, \$7,000; o, H Van Ryn.

9 bldgs less than \$7,000.

MILWAUKEE.—Depot; o, C & N W R R; a. Cobb & Frost.

CHICAGO, ILL.—154-55 Michigan av, br addn to store; cost, \$12,000; o, W F. Richie; a, I L Tarbel; b, Prath & Nieterlik.

N e cor Randolph and Central av. nger station; cost, \$12,000; o, Ill Cent R R; a, J Nocquet.

87 Astor, br dw; cost, \$9,000; o, W H Warren; a, Cobb & Frost; b, L Weick. 143-45 Douglas av, br store and flats; cost, \$9,000; o, W I. Bigley; a, Treat & Foltz; b, Nicholson & Weber.

292-96 Wood, br addn to dws; cost. \$14,-000; o, Presbyterian Hospital; a, S V Shipman; b, C W Danier.

BOSCOBEL, WIS.—Ruka Bros. Mfg. Co. will build an \$18,000 wagon factory, foundry and blacksmith shop. New engines will be purchased.

BALTIMORE, MD .- Portland nr Greene, 1 3-story br warehouse; o, W Reisinger & Son.

Preston nr Proctor al, 3 3-story br bldgs; o, F H Shalters.

Eager nr Gay, I 3-story br bldg; O, Geo Kirschenhofer.

218 Harrison st, 1 3-story br bldg; o, Solomon Harris.

Stirling nr Monument, 1 3-story br bldg; o, Geo Schilling. Portland nr Tremont, 5 3-story br bldgs;

o, Chas H Markland; b, same. Orleans nr Central av, 1 3-story br bldg; o, Jno Geo Eichler.

Central av nr Hoffmann, 1 3-story b bldg; o, Mary F Cole.

Caroline nr Preston, 2 3-story br bldgs; o, I G Magarity & Co.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE RAPID-TRANSIT PROBLEM IN NEW YORK.

In the brief comment in last week's issue on the communication from "Inter-Metropolitan" regarding the rapid-transit problem in this city, we stated that we welcomed the proposed Elm Street tunnel on the principle that "half a loaf is better than no bread." This has brought out a letter from an engineer who is familiar with the underground roads of London and the elevated viaduct roads of Berlin. In it he commends what he calls Mayor Hewitt's plan of a viaduct road on the east and west sides of the city. He says:

"The Mayor is right after all in what appears to be his factious opposition to the Elm Street improvement, for an underground road is not what is wanted in New York. If you go underground, you lose natural light and air, and no artificial means will ever make up the loss. One has only to use the London underground and the Berlin viaduct in the same week, so as to make fresh comparison, in order to appreciate this fully and remember it long. The ultimate solution of the rapid-transit problem must lie in two roads, one on the east side and one on the west, of solid masonry, at a height not less than 18 nor more than 50 feet above street grades, of strength to carry four tracks and 35 ton locomotives. Anything else will be a half-way measure, like the present affairs on stilts, which, in barely ten years, have outgrown their usefulness."

For the information of our correspondent, and those of our readers who may not be aware of the fact, we would say that this journal has advocated substantially this system for several years back, and our unwillingness to oppose an underground rapid-transit scheme was due solely to our appreciation of the imperative needs of further facilities for getting up and down town; and, as we stated, we had rather have "half a loat than no bread." In our issue of January 28, 1886, we stated in an editorial on this subject:

" It is certain that the requirements of rapid transit are not fulfilled by railroads on the surface of the ground, on which heavy motors, noisy in their operation, run at high speed, as they do in the suburbs of Boston, New York, and Philadelphia. They are not fulfilled by passenger cars, heated by coal stoves, and swept by a draught of cold air from a tilting transom over the end door, as is the barbarous custom on the Pennsylvania and Hudson River Railroads. They are not fulfilled by iron trestles built over public streets and too flimsily constructed to carry motors of sufficient power to draw the necessary loads and yet carrying machines which are so noisy in their operation as to be a frightful nuisance. Still less can the necessary conditions of comfort and health be fulfilled by any subterranean structure, such as is suggested for Broadway. We believe that the day is rapidly approaching when large cities will be traversed by viaducts constructed on property exclusively dedicated to that purpose, and on which trains of cars will be propelled at high speed through the open air by nearly noiseless motors, two tracks being devoted to long distance and two to short distance travel."

Capitalists who have hitherto furnished rapidtransit facilities for New York have wanted the inducement of being able to water the stock and make money in other ways than by carrying passengers. This has, no doubt, had the effect of making it a difficult matter to secure capital to build a road for the prospective earnings of capital honestly expended. We are inclined to believe that before money will become so cheap

in this country as to secure its employment in this legitimate way, this city's growth and prosperity will be retarded, unless the city itself undertakes the construction of these highways. We therefore look with favor on the suggestion attributed to Mayor Hewitt that the city now build at least one of these highways and lease it on fair terms to some corporation who will operate it for the convenience of the public and a reasonable return. The great cost of such an undertaking and its unquestioned value to the city, to say nothing of the compensation to be reasonably expected for the lease, would seem to make it quite as proper an object on which to expend the public funds as the widening or opening of a street or the construction of a bridge. Some provision, however, should be made that would insure the payment of the greater portion of the annual cost by the property owners of the upper part of the city, who will undoubtedly derive the greatest advantage.

MUNICIPAL BUILDING METHODS.

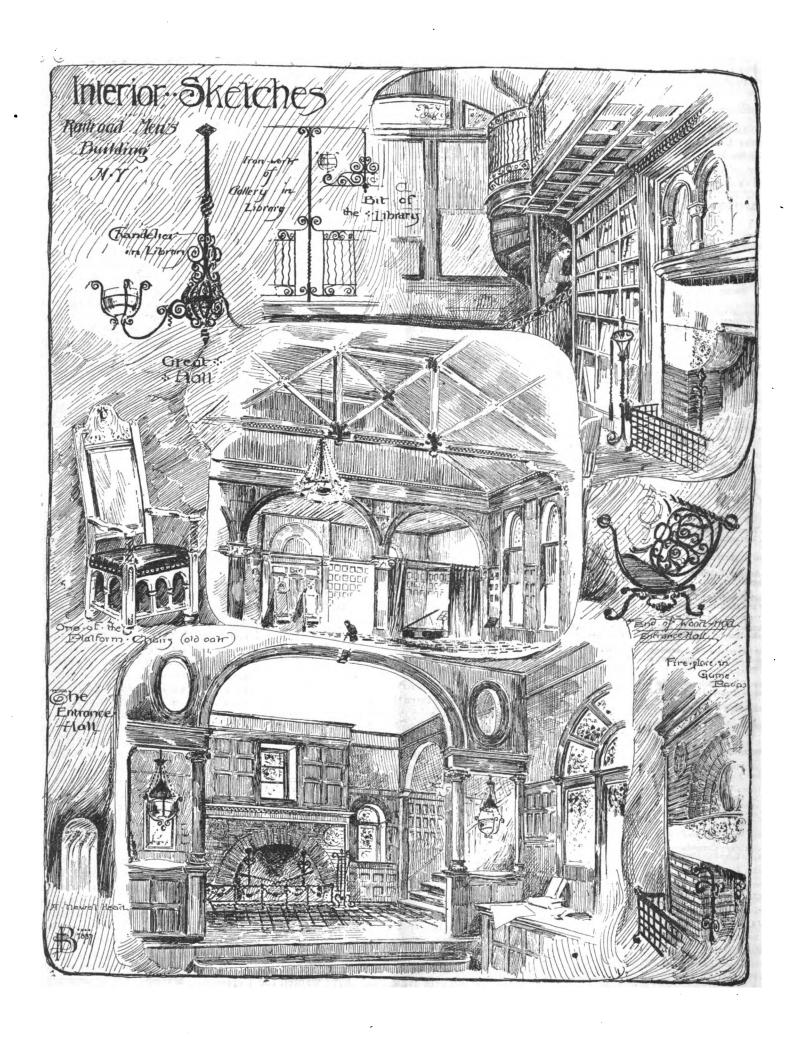
A RECENT editorial in the Syracuse Standard, discussing the architectural competition invited for the proposed additions to the New York City Hall, treats the whole matter so forcibly and well that we cannot refrain from giving our readers the benefit of some of it, as the principles enunciated apply to a much wider range of cases than the specific one that called it forth.

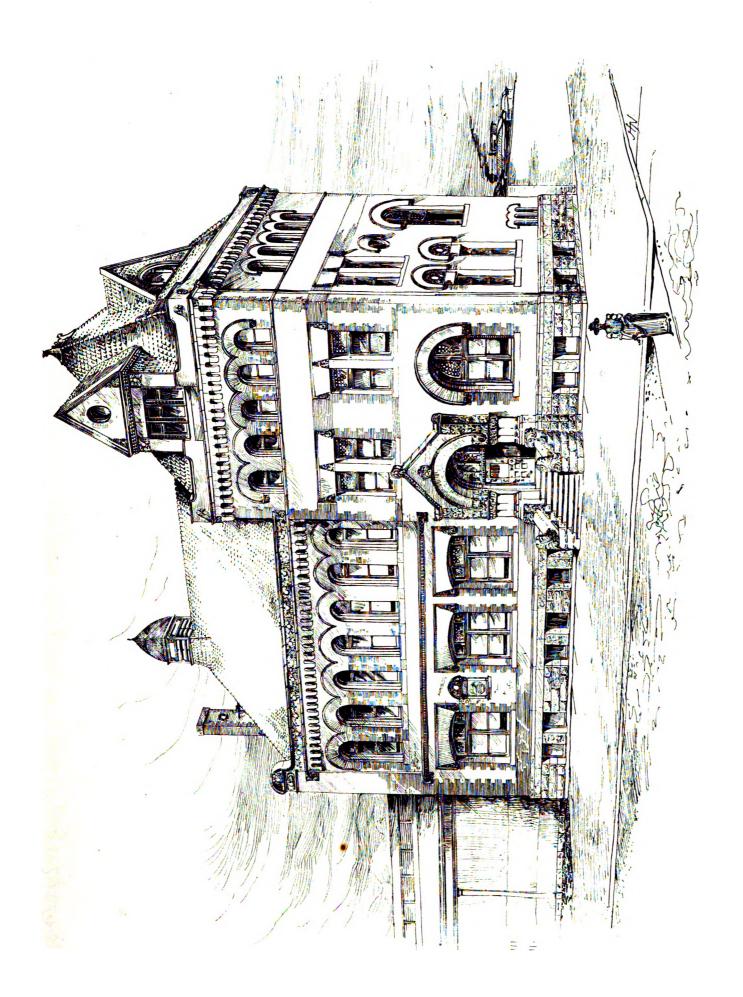
After a friendly notice of the views recently expressed in this journal on the same topic, the Standard goes on to say:

"It is the old story of beginning economy in building by employing a poor architect, for no good architect will have anything to do with a competition in which the best design is almost certain to be thrown out by the incompetent committees which usually manage big municipal or State jobs of building, and when, even if accepted, the recompense is inadequate to the expense. The truth is, that a first-rate architect can build a handsomer and more convenient structure for six million dollars than a fourth-class architect is able to build at all; but a public building committee, nine times out of ten, prefers to save a few thousand dollars on an architect, and expend from one hundred thousand dollars to millions of money in partially adapting an inherently bad building to purposes for which the architect apparently never intended it."

This, unhappily, has been too often illustrated in New York City to require any further comment from us, and New York's shortcomings in this respect are brought out in even stronger light by our contemporary by contrast with the more sensible methods pursued by her sister city up the river:

"Albany, when she built a City Hall, went to work precisely as a gentleman of wealth and taste proceeds when he purposes the erection of a house. He gives to the best architect he can find an idea of the purposes and general character of his future residence, together with an estimate of its cost, and leaves the details to the architect. That is a sufficiently simple plan, and by it the best results are accomplished. In the construction of municipal and State buildings it is as well to give all architects an opportunity to compete for the commission of furnishing plans, but prizes of sufficient size to compensate the best architects for their trouble should always be offered, and the building committees, contrary to custom, should be composed of gentlemen who know the difference between the Stonehenge and the Renaissance style of architecture. The ignorance of building committees is proverbially colossal, and would be ridiculous were it not sinful."





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

RAILROAD MEN'S BUILDING, NEW YORK.

It is earnestly to be hoped that the committee having this matter in charge will realize the greatness of their opportunity and be inspired thereby to take adequate means to fully and satisfactorily accomplish their task, for, to quote again from our Syracuse contemporary,

"New York will soon be the greatest city in the world, and it must always remain the metropolis of the Western hemisphere. Its new City Hall will last for several hundred years, unless it tumbles in, or future generations become ashamed of it and tear it down. There is enough architectural talent in New York City to construct a splendid building that shall be a worthy monument to this rich and progressive generation. Instead, the city is quite as likely to have an unsightly pile of stone and iron as badly adapted to the uses of a municipal building as the genius of ignorance and bad taste can make it. If Mayor Hewitt were always as wise as he sometimes is, he would not sanction the present system of competition among fourth-class architects for the construction of the worst possible building at the greatest possible expense."

THE THIRD ANNUAL EXHIBITION OF THE NEW YORK ARCHITECTURAL LEAGUE.

THIS exhibition was opened on Saturday evening, December 17, with a reception to Mr. Richard M. Hunt, the newly elected President of the American Institute of Architects.

The rooms, at the Fifth Avenue Art Galleries, 366 Fifth Avenue, were crowded all the evening by members and their friends, making of the reception a most brilliant success. The private view was quite a secondary matter, seeming merely an opportunity embraced by the League to express its respect for and do honor to the guest of the occasion.

The rooms, three in number, are used for this exhibition for the first time and are exceedingly well adapted to their purpose.

The first and second rooms, after entering, are devoted to the display of purely architectural work, while the third contains the work in the allied arts—viz., decorative sculpture, decorative painting and design, tapestries, leather and metal work, inlay, and all that goes to the fitting and furnishing of the interior.

In the first room, at the right on entering, are the forty-three designs submitted in competition for the gold and silver medals, which have already been noticed in these columns. The jury of award announced the names of the winners at the reception. The gold medal to James A. McLeod, of Minneapolis, Minn.; the silver medal to W. B. Mundie, of Chicago, Ill., and honorable mention to Julius Harder, 237 Broadway, New York City, William C. Noland, 212 South Third Street, Philadelphia, and Timothy F. Walsh, Cambridge, Mass.

It will be noticed that but one of the selected designs is from New York, while both the medals have gone to the West.

Almost all of the south wall of this first room is given up to the beautiful drawings of the great Hotel Ponce de Leon, at St. Augustine, Fla., by Carrere & Hastings, architects. The drawings, in both pen and ink and water color, are by Blum, Rosenberg, and Bucher. In this room also may be noted No. 300, a very clever etching of Trinity Church, this city, from Trinity Place, by Henry S. Ihnen; No. 267, model in plaster of the salon in house for G. J. McGourkey, in this city, by John H. Duncan, architect: the absence of color on the plaster is to be regretted. No. 284, Sanitary Geography, by Edward Potter, a very queer drawing, with several yards of text attached. the whole meaning something which "no fellow has been able to find out;" No. 277, two photographs of the interior of William F. Weld's beautiful house at Brookline, Mass., by E. M. Wheelright. It is a pity that they were not colored drawings.

Going into the second room, which contains the greater number of the architectural drawings, one is immediately struck by the comparative absence of representations of work of any magnitude. With the exception of No. 204, an unsatisfactory drawing of the not very satisfactory tower for the new Madison Square Garden, by McKim, Mead & White, No. 197, the New York Life Insurance Company's building in Kansas City, by the same architects, the same company's building in Montreal, by Babb, Cook & Willard, and a few large country houses, the rest of the drawings are of small and comparatively unimportant work. This, without doubt, will strike the

unprofessional observer; but it is to be accounted for by the actual unimportance of the work of the past year.

At the entrance to this second room, on a stand by the door, is a very interesting and curious drawing, No. 314 A. This is the original suggestion of George Washington to his architect for the design of Mount Vernon; drawn by George Washington and loaned by Mr. S. L. M. Barlow. On the back of the sketch is this note: "If this plan should be adopted the doorway here marked need not (as the hall is already built) be cut now—it may be cut hereafter."

About the entrance to this room is the series of beautiful drawings, Nos. 1-33, of the English cathedrals. These are by Joseph Pennell, and loaned by the Century Company, and are in pen and ink and *gouache*, and most excellent examples of this mode of rendering architectural subjects.

Nos. 33 and 37 are lovely color drawings of Moorish Interiors, by Louis Tiffany. No. 43 a clever church at Saratoga, by A. Page Brown. No. 47 a beautiful penand-ink drawing. by Henry New, of W. D. Sloan's house at Lenox, loaned by The Engineering and Building Record. No. 59 is a most surprising drawing of "A Garden House," by E. L. Wakeman, which was evidently hung to fill a space. It had better been hung with its face to the wall.

No. 88 is a beautiful drawing in color of a Venetian palace, by S. W. Meade. The delicacy and charm of this is admirable.

. John H. Duncan has, in No. 99, a clever drawing, in color, by C. S. Luce, of his house for G. J. McGourkey.

No. 121 is a large pen-and-ink drawing, by W. C. Hazlett, of the Orange Heights Hotel, by Arthur D. Pickering. The design is very fine—a great simple stone building, flanked by two massive towers, the whole rising from a sheer rocky wall, the entrances being supposably from the other side.

The post of honor in this room has been given to some drawings made by Richard M. Hunt when he was a student at the Ecole des Beaux Arts and drawing in the atelier of M. Lefeul. Chief among these is a series done for the French architect when he was completing the Pavilion de la Bibliothéque of the Louvre, begun by Visconti. The others are drawings in a competition Ecole projet.

Just to the right of these are some very interesting drawings by John Ruskin and J. M. W. Turner, loaned by Charles Eliot Norton. One of the Ruskins, No. 170, a part of St. Mark's, Venice, is in the master's best style.

No. 184 is a drawing in pen and ink, by Charles McKim, of McKim, Mead & White's design for the Cambridge Library. It is a very beautiful and delicate drawing of a charmingly quiet and dignified design.

No. 217 is a lovely drawing, by Prentice Treadwell, of Bruce Price's design for the great hall in the house of F. W. Sharon, in California. Mr. Treadwell also has several other drawings of interior subjects, all of which are in excellent color.

C. Howard Walker shows two very nice color drawings of his church at Springfield, Mass.

Bruce Price has a fine pen-and-ink drawing of a house at Tuxedo in No. 86, and another in "Stone Acre," Newport.

Mr. Luce has some of his charming water-colors in No. 135, a cottage at Jamestown, and also in some drawings he has made for George Martin Huss.

Drawings by W. M. Kendall, Wilson Eyre, Jr., Rossiter & Wright, A. W. Brunner, C. I. Berg, W. C. Hazlett, Cass Gilbert, J. A. Schweinfurth, Rotch & Tilden, are also worthy of note.

It is surprising, and somewhat disappointing, that the profession outside of New York is so slightly represented. With the exception of half a dozen from Chicago and St. Paul, the same number from Boston, a few from Philadelphia and a handful scattering, the exhibition is entirely from this city. It is a pity it is so, since the League, though local in its voting membership, is open to all persons interested in architecture or the allied arts, and would gladly receive, and in fact seeks, for contributions to its annual exhibition.

The loan collection, which has been under the immediate care of Messrs. John Gellatly, H. O. Avery, and Frederick Crowninshield, is in the third room, and a very beautiful and instructive collection it is. The position of honor is given to Mr. St. Gaudens' plaster bas-relief of the late H. W. Bellows, D. D. This sculptor also exhibits the

Schiff children, while Mr. Hartly has his bas-relief of Lincoln.

The Associated Artists show several tapestries from designs by Dora Wheeler. "Penelope" is exceedingly nice. Some of the others are not. Mr. John La Farge shows a series of sketches for windows and studies for figures in windows, together with some Japanese views, all in most lovely color. Mr. T. W. Dewing has his exquisite figure of "The Symbolic Angel." Mr. F. S. Church is represented by several of his poetical works loaned by John Gellatly. One of these has a most interesting carved Italian frame.

W. H. Low's fine series of drawings illustrating Keat's "Odes and Sonnets" are most exquisite in their delicate drawing.

There are also some fine stamped and embossed leathers and leather-work loaned by Yandell & Co., which, together with inlaid work, painted panels—those by Jac. Gallaud, fils. are very nice—embroidered stuffs, from the Associated Artists and the Society of Decorative Art, wrought iron and brass, etc., etc., making a very gorgeous show.

As a whole, the exhibition is the best we have yet had in this country. What the architectural part of it lacks in interest it more than makes up in size.

There is, perhaps, a little want of plan in hanging, but that is more than counterbalanced by the effect that has been obtained.

THE NEW YORK ASSOCIATION FOR IMPROV-ING THE CONDITION OF THE POOR, AND THE HOSPITAL SATURDAY AND SUNDAY ASSOCIATION.

THE fourty-fourth annual report of the New York Association for Improving the Condition of the Poor opportunely makes its appearance at this time when charitably disposed persons are considering the mediums through which their gifts may do the most good to the deserving poor. The economy and intelligence with which this society's affairs are managed entitle it to a liberal support.

It is gratifying to note their commendation of the efforts of the Health Department under the presidency of Mr. Bayles to improve the character of the tenement-houses. We advise all persons interested to send for a copy of this report to John Bowne, 79 Fourth Avenue, New York City.

The Hospital Saturday and Sunday Association also reminds the public that the time is approaching for taking up their annual collections in behalf of the hospitals of New York City. Last year's collections in churches of all denominations amounted to \$33,784.66, and from trades, professions, and other sources \$20,267. During the past year the hospitals assisted by this association cared for 13,920 bed patients of whom 10,157 were free patients, besides operating upon or giving medical aid to 119,124 free dispensary patients. Persons who recognize the value of the work of our hospitals will do well to place their donation in the hands of this association.

OUR ARCHITECTURAL ILLUSTRATIONS.

RAILROAD MEN'S BUILDING, NEW YORK.—R. H. ROBERT-SON AND A. J. MANNING, ARCHITECTS.

THE Railroad Men's Reading-Room, shown this week in our special and detail illustrations, in this city, was built by Mr. Cornelius Vanderbilt for the use of the operatives of the New York Central Railroad.

The building consists of two distinct portions, a corner pavilion on Forty-fifth Street and Madison Avenue, and a wing facing upon Madison Avenue. The first division includes a gymnasium in the basement; on the first floor, the entrance-hall, offices, and staircase: on the second, class-rooms; and above this the janitor's apartments. The basement plan of the wing shows the various baths, the water-closets, and the boiler-room. Over these are the social-room, reading-room, and the library, and beneath the roof of the wing is the great hall.

The roofs are covered with dark-toned red tile. The walls are built of yellowish mottled brick. The principal

The roofs are covered with dark-toned red tile. The walls are built of yellowish mottled brick. The principal angles, the circular heads and jambs of doors and windows and the sill-courses are laid in red brick. Terracotta is extensively used for cornices, raking courses, panels, crestings, finials, and at arch imposts. The interior is finished in hard wood.

The special domestic engineering features of this building are discussed elsewhere.

The architects were Messrs. R. H. Robertson and A. J. Manning, of this city.

INTERIOR OF RAILROAD MEN'S BUILDING.



BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No XXVIII

(Continued from page 42.)

HEAD-HOUSE ON THE NEW CROTON AQUEDUCT AT SHAFT 22.

In a previous article we have given a description of plant and its location relative to the shafts, and will now illustrate and describe a head-house, built over a shaft, in which the appliances are located for transmitting down the shaft the power which has been generated in the plant, so as to facilitate the discharge of material excavated in the headings, and to receive all building material required for constructing the tunnel which is delivered for that purpose.

The frame of this head-house is secured by the ordinary mortise and tenon joint, in connection with iron bolts (that are three-quarters of an inch in diameter) at points indicated in the illustrations.

This head-house is constructed in the form of a parallelogram, the dimensions of the exterior being 19 feet 6 inches by 10 feet, and the ground plan of the sills is shown in Fig. 1. At a a short posts are indicated, to which one end of the cross-beams h h are bolted, forming part of the support for three platforms, i, i and j, to be hereafter described, which can be seen in Figs. 2 and 3.

In Figs. 1 and 2 b b represent the guide-posts and guides; the latter, being shown in black, are bolted to the guide-posts, both extending from bottom of tunnel to the plates of head-house. The guide-posts on one side are 6x12 inches, but on opposite side, where they are secured to a 12x12-inch timber forming part of the frame, the guide-posts are 3x10 inches. The guide is 2½x3 inches and fits in a groove provided in the sides of cage-frame, thus compelling the cage to move at all times in a vertical position. On these cages the employees as well as all material from excavation in the tunnel or for construction are transferred either down or up the shaft as circumstances may require.

In Fig. 1 c c represent the galvanized sheet-iron pipes, 12 inches in diameter, used as a conduit from blower to supply fresh air to the tunnel or to draw foul air from it. At d the location of compressed-air pipe, 5 inches in diameter, is given, and at e the discharge-pipe from pumps located by the sump at foot of shaft. The black circle between d and e indicates the steam-pipe that delivers the steam to operate the pumps, and f shows the electric-light wires.

Figure 3 represents a side elevation and Fig. 2 a sectional view of head-house. The plates k are similar in

FIGURE 2.

plan and detail of construction as the sills, the only difference being that the posts a a only extend to tipple platform and therefore have no connection with the plates.

The plan of the tipple platform i was illustrated and described on page 291 of Vol. 16, and, therefore, it is unnecessary to repeat description here. Tipple platforms similar in plan were built at each end of the head-house and are both utilized when a full force is working in the headings.

The braces l/l are composed of 6x8-inch timber and extend from sill to plate, let into the posts m m six inches, and made flush with them. These braces are securely bolted to posts n, m m, and g g by iron bolts three-quarters of an inch in diameter. The opposite side of frame corresponds in details of construction. Small angle braces 6x6 inches, indicated at o in Fig. 2, are placed at each end to protect the two end bents from lateral motion.

The posts g g, Fig. 3, are braced as shown in Fig. 2. The braces are bolted where they cross each other and bolted also at top and bottom to the posts against which they rest. These braces, extending as they do from top to bottom of the head-house frame, firmly secures this frame from any possible cross strains that it may be called upon to resist.

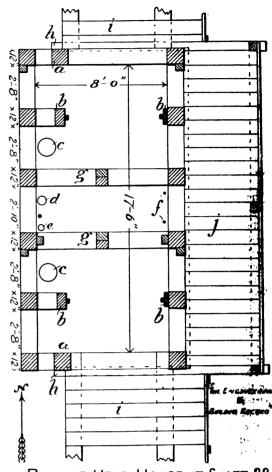
The longitudinal strains are also equally well provided for by the braces l, also extending from sills to plates, and bolted at centres to the posts m, and the ends to posts n and g g.

The Otis hoisting-engine used at this shaft to operate the cages is located at the northerly end, and about twenty-eight feet distant, the wire ropes r and s extending to it. A plan of the relative position of the hoist to shaft was given on page 676, Vol. 16, to which the reader is referred. To further secure the frame of head-house from longitudinal strains in operating the cages, as the maximum strains will be in the direction of the hoistengines, additional braces, indicated at p, have been placed at the northerly end, firmly secured to top of frame and anchored in the ground about twenty-two feet from sill of head-house. There are two of these braces, one at each corner at end of frame, eight feet apart, but distance between them diminishes to five feet at end of tipple platform. The windlass w, used in operating the tipple, is attached to these braces, as the height is convenient for that purpose, but the windlass on the platform at southerly end of head-house is supported on vertical standards.

The sheaves t, u, and v rest on 12-inch timbers, shown at y in Fig. 3 and in section at Fig. 2. These timbers are securely bolted to frame by 1 $\frac{1}{2}$ -inch rods, indicated by dotted lines x at seven different points in Fig. 3.

A careful inspection of Figs. 2 and 3 will show the

detail of the roof sufficiently clearly, therefore making a detailed description unnecessary. The roof projects beyond the frame three feet at each end, thereby increasing the protection to the mechanical appliances in the head-house from northerly and southerly storms. The sides of the frame are covered with boards laid in a horizontal position.



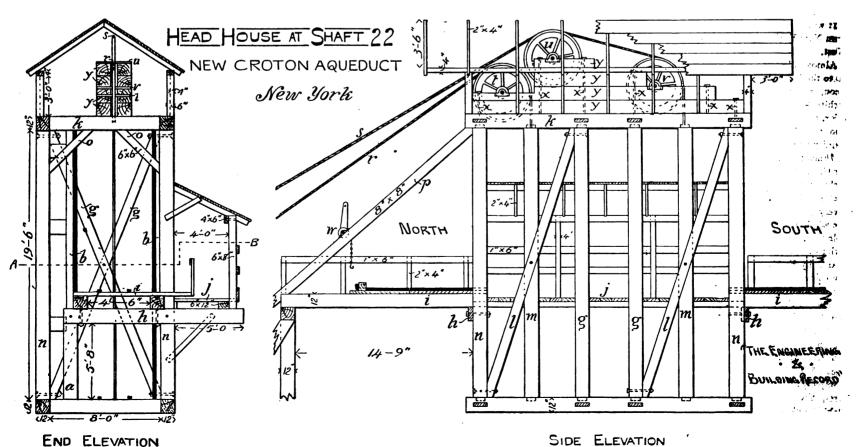
PLAN OF HEAD-HOUSE AT SHAFT 22

• TAKEN ON LINE A-B •

Fig. 1.

The corner standards resting on the plates supporting the roof are 4x6 inches, but the intermediate standards are 2x4 inches, all being capped by a scantling 4x6 inches on which the rafters rest, but the latter are 2x4 inches.

The platform extending the entire length of headhouse indicated at j in the longitudinal view, Fig. 3, in



SIDE ELEVATION FIGURE 3.



plan Fig. 1, and in section Fig. 2, is intended for the use of the man who operates the cages, as the Otis hoist is controlled by a hand rope the same as an ordinary elevator. This platform is accessible by a flight of steps, which can be located at any convenient point.

(To BE CONTINUED.)

PAVEMENTS AND STREET RAILROADS. No. XXII.

(Continued from page 37.)

SPECIFICATION FOR WOOD PAVEMENT, PARISH OF ST. GEORGE. *

The specification given below is one of the best recently written for wood pavements in London. Among the things to be noted are: the requirement of a space next each curb to allow for expansion; The requirement that the contractor give his own levels, etc., and making him responsible for their accuracy; the six months' maintenance without charge; the repair by the contractor of all openings in the street, at a fixed price per yard; the sweeping and cleaning of footways during progress of the work; and, lastly, that the contractor shall be present "whenever required, for the purpose of measuring and ascertaining the quantity of work performed," or else that he shall accept the measurement then made by the surveyor.

PARISH OF ST. GEORGE, HANOVER SQUARE, LONDON.

- Specification for Paving with Wood the Carriageways of Buckingham Palace Road (from the Grosvenor Hotel to Ebury Bridge), Conduit Street, Half-Moon Street, Pimlico Road, Queen Street, and Wilton Road, —George Livingston, Surveyor.
- 1. Description of pavement and mode of laying.—The pavement is to be composed of creosoted blocks, cut from the best yellow deal of first quality, 9 inches, 8 inches, and 7 inches long by 6 inches deep and 3 inches wide; no block to be more than 9 inches nor less than 7 inches in length. Each block to be cut perfectly true in size and shape. The joints to be filled in with mastic asphalt of approved quality to a height of at least $\frac{1}{2}$ 4 of an inch, measured from the bottom of the block, the rest to be filled in with Portland cement grouting, and no joint to be more than $\frac{1}{2}$ 6 of an inch in width. The blocks laid transversely are to be only laid to within 3 inches of the curb on each side of the street (to allow for expansion), the space so left to be filled in with Portland cement and sand, as shall be directed, but subsequently made good with blocks if necessary. No paving to be commenced on any portion of the foundation until six clear days after the concrete has been laid.
- 2. Creosoted blocks.—The whole of the blocks used in the work to be creosoted to a mixture of pure creosote, G. oil, and pure distilled tar, in proper proportions as shall be approved, but no blocks shall undergo this process until they have been first inspected and approved of by the surveyor, or other authorized officer; and the surveyor shall have full power, notwithstanding such inspection, to split in two any reasonable number of blocks selected indiscriminately from those brought on to the works, and to reject any that he may consider unfit for use; the same to be at once removed by the contractor.
- 3. Excavation.—The contractor to excavate the whole of the present macadamized roadways to the required depth to form foundation and pavement, such of the old macadam as the surveyor shall approve, if sifted and mixed with Thames ballast, to be used for concrete; the surplus to be the property of the contractor, who shall at once remove the same at his own cost.
- 4. Cement.—The whole of the cement supplied for the works must be of the best quality, and from an approved manufacturer, and must conform to the usual tests to the satisfaction of the surveyor.
- 5. Concrete. The concrete to be composed of Thames ballast (mixed with such of the old macadam and in such proportions as the surveyor shall approve) in the proportion of 7 parts by measure of hard core to 1 part by measure of cement; the surface to be finished off to a smooth face with concrete 1 inch in depth, composed of Thames sand and Portland cement, in the proportions of 3 of sand to 1 of cement, and to be laid a depth of not less than 6 inches over the whole area of the street (from curb to curb), and to be composed of the best Portland cement, subject in every respect to the approval of the surveyor.
- 6. Old paving stone.—All the paving stones in channels and crossings, etc., to remain the property of the vestry, at whose expense they will be taken up and removed.

GENERAL CONDITIONS.

- 7. Contractor to provide all materials, labor, tools, etc.— The contractor shall provide all materials, labor, tools, tackle, implements, etc., for the proper execution of the works. All the materials used to be the best of their respective kinds, and applied in the most workmanlike and substantial manner possible, and to the entire satisfaction
- * This pavement mentioned in the specification was laid in two contracts at prices respectively of 8s. and 8s. 2d. per square yard.
- † The surveyor considers that all blocks should be creosoted under a pressure of 10 to 12 pounds per super foot.

- of the surveyor. The blocks shall be of the best yellow deal, of first quality, and the surveyor shall have full power to reject any materials which he may consider unfit to be used in the work.
- 8. Setting out.—The contractor to set out and keep correct the works in every particular according to directions he may receive from time to time, and to be responsible for the correctness of the same throughout the whole term of the contract.
- 9. Maintenance after completion.—The contractor is at his own expense, and without charge to the vestry, to maintain the wood pavements, together with their foundations, in a state of perfect repair to the satisfaction of the surveyor to the vestry, for a period of six months from the date of completion of the entire work.
- 10. Maintenance by the Vestry.—Should the vestry determine itself to maintain and repair the pavement of any or all of the streets at the expiration of the period during which the contractor is to keep it in repair free of charge, he is to be bound, if so required by the vestry, to execute such repairs as he may be called upon to make at a price per superficial yard to be hereafter agreed upon. In all cases the old materials are to become the property of the contractor, and to be carted away by him without expense to the vestry.
- ontractor is, during the term of his contract, and at any time after its expiration, if so required, to repair, within twenty-four hours after notice, all damage done to the pavement by, or in consequence of, the operations of gas or water companies, or other public or private bodies, or by the vestry itself, and he is to do the work for such companies, or others, at a price per superficial yard (to be stated in his tender) measured as repaired. All old materials to become the property of the contractor, and to be removed by him at his own expense.
- removed by him at his own expense.

 12. Cleaning and sanding surface.—The vestry is to be at liberty to cleanse the pavement with water or by sweeping or scraping either by hand or by machines or in any other way it may be deemed expedient, and may also strew the surface with fine sand, gravel or other materials with a view to prevent slipperiness, and the contractor is to have no claim for increased wear of the pavement should it result from the usage of such material, or from any mode adopted for cleaning the surface.
- 13. Fencing, watching, and lighting.—The works are to be carefully fenced, watched, and lighted, during their progress, both by day and night, by the contractor at his own expense.
- 14. Footways to be kept clean.—The contractor is to sweep and keep clean footways from ballast or any other material, so far as may be practicable during the execution of the works.
- 15. Injury to curbs and footways.—Should any portion of the curb stones or footway pavements be injured or displaced by the contractor's workmen, they are to be reinstated at the contractor's cost by the workmen of the vestry, and such cost may be deducted from any sums then due or that may become due to the contractor.
- 16. Injury to sewer, gas, or water mains.—Should any injury be done either to the sewers or their appliances, or to gas or water pipes or their appliances, by the contractor's workmen, the damage is to be made good at the contractor's expense, and the cost thereof may be deducted from any money then due, or that may become due to the contractor.
- 17. Refixing gas and water boxes at altered levels.

 The parish workmen will raise or lower as may be required all water or gas boxes, gully grates, manhole covers, etc., to suit the new pavement at the expense of the vestry.
- 18. Dismissal of workmen for misconduct.—The contractor is to dismiss from the work any agents, workmen, laborers or others in his employ for misconduct, if required to do so by the surveyor.
- 19. Services of notices upon contractors.—All notices to the contractor, his foreman or agents, shall be deemed to be duly served upon him by their being delivered personally to any of his agents, or sent by post to his offices for the time being; and notice of such offices or the contractor's address is to be left with the surveyor to the vestry.
- 20. Works to be executed as the surveyor directs.—The work is to be executed in such manner, lengthwise and widthwise of the streets, and at such times as the surveyor may direct, and be carried on in such a way as will least impede the business of the neighborhood and the public traffic, and so as not to obstruct or endanger passengers, animals, or vehicles more than may be absolutely necessary.
- animals, or venicles more than may be absolutely necessary.

 21. Works to be done to the satisfaction of surveyor.—

 All work is to be executed and maintained throughout the contract to the satisfaction of the surveyor to the vestry for the time being, whose directions as to the work required and manner of performing the work are to be abided by; and his opinion on all points, both as regards execution and maintenance, and as to the moneys due to the contractor, shall be binding, final, and conclusive
- 22. Clerk of Works, etc.—The contractor is to obey the instructions given him by the clerk of works to the vestry, the surveyor's assistants, or other competent persons who may be deputed by the surveyor to superintend any part of the works.
- 23. Contractor to re-execute improper work.—If any part of the work shall at any time, in the opinion of the sur-

- veyor, be imperfectly executed, the contractor is, at his own expense, on the requisition in writing of the surveyor, to remove the same and replace it with good sound work to the satisfaction of the surveyor.
- 24. Upon neglect to re-execute work.—Should the contractor, for the space of forty-eight hours after receiving instructions from the surveyor, neglect or refuse to execute or amend any of the work which he may have improperly executed, or should fail to complete the work in time, or to maintain the work properly during the contract term, the vestry shall have full power to execute the work themselves, by their own workmen, or agents, and deduct all expenses incurred from any moneys that may be due or become due to the contractor, or may recover the same as the law directs.
- 25. Contractor responsible for accidents and losses to the Vestry.—The contractor, during the whole term of his contract, shall be held responsible for all accidents which may take place by reason of his works, or for want of repair in the pavement which he may undertake to maintain, whether notice of need of repair shall have been given to him or not; or for delay in executing repairs over openings made by the vestry, or others, after due notice has been given to him to make such repairs; and he shall indemnify and hold the vestry, and its officers, harmless against all actions, claims, compensations, losses, costs, and charges whatsoever in respect of the paving works, or anything arising out of the contract. And the vestry shall have full power to deduct the amount of such costs, losses, etc., accruing or arising out of such accidents and compensation, or from any defect or omission on the part of the contractor in maintaining the pavement in a suitable condition, or performing the repairs in a suitable manner, and the vestry shall further have power to recover such amounts from the contractor as the law may direct.
- 26. Time of completion.—The contractor is to complete and finish the work according to the provisions and true intent and meaning of this specification, fit and ready for public traffic, within the following time from receiving the order from the surveyor to commence the work—viz.: Buckingham Palace Road, within eight weeks; Conduit Street, within four weeks: Half-Moon Street, within three weeks; Pimlico Road, within four weeks; Queen Street, within two weeks; and Wilton Road, within three weeks. And the contractor shall forfeit the sum of £5 per day by way of liquidated damages for any delay beyond the specified time and the vestry may deduct the same from any moneys that may be then due, or become due to the contractor; but should the contractor be unable, owing to bad weather or other unavoidable causes, to proceed with the works, then such extension of time may be granted as the surveyor may think fit and reasonable.
- 27. Measurement of work.—Upon the completion of the work, the contractor, by his agent or foreman, is from time to time, whenever so required by the surveyor, to attend at such time and place as shall be named by him for the purpose of measuring and ascertaining the quantity of the work performed, and in default thereof, the surveyor shall be at liberty forthwith to measure and ascertain the quantity himself, and his decision as to the quantity shall be final, binding, and conclusive upon all parties.
- 28. Payment.—No payment shall be made by the vestry to the contractor for any work done or materials brought upon the ground until the surveyor shall have certified in writing that the work is completed according to the provisions of this specification, and to his entire satisfaction.
- 29. Mode of payment.—The following payments will be made upon the work when certified by the surveyor: 90 per cent. of the total amount one month after the completion of the work, the remaining 10 per cent. at the expiration of the contract—namely, six months from the date of completion of the work.
- 30. Sureties.—The contractor will have to provide sureties (in such amount as the vestry may consider necessary) for the due fulfillment of the contract.
- 31. Tender not necessarily accepted.—The vestry does not bind itself to accept the lowest or any tender, and reserves to itself the power to give the whole or any portion of the work to any one or more parties tendering, and to increase or diminish the quantity of pavement to be executed under this contract, without in any way invalidating the same.
- 32. The contractor may tender for any or all of the streets mentioned, and state in his tender a separate price per yard for each street, or he may state one uniform price per yard at which he is willing to undertake any or all of them.

Note.—The works will be commenced and proceeded with at once. Each street to be completed within the limit of the time separately specified, but the whole of the streets included in the contract must be completed within a period of nine weeks from the date of the commencement of any one of them

ment of any one of them.

The contract to be drawn up by the Parish Solicitor at a cost to the contractor not exceeding £5.

February, 1886.

One guinea is charged for this specification and form of tender, which will be returned on receipt of a bona fide tender.

The pavement called for in these specifications is the "improved wood" pavement, and in October following their issue, Mr. Livingstone reports on the comparative



expense attending macadam pavement on Piccadilly, and proposed improved wood pavement on Knightsbridge. The average amount of broken granite used per year for five years on 8,577 square yards of surface was 1,090 tons, costing for freight, carting, labor, rolling, watchmen, etc., 2s. 81/2d. per square yard; and for the future he estimates it would be on Knightsbridge 3s. per yard.*

Cleansing macadam in Piccadilly costs an average of 10d. per square yard per annum. For Knightsbridge it would be two cart-loads of sweepings a day in dry weather, and ten loads in wet weather; and as statistics show wet days for one-half the year, there would be 1,872 loads at 4s, per load, or a cost of 11d. per square yard per annum on 8.218 yards. For wood, the estimate is 3d, per square yard.

Including cleansing, watering, maintenance, and a proportional part of first cost and interest divided over fifteen years, he estimates a saving in the use of wood over macadam of about 1s. per yard per year.

The wood pavement can be contracted for at 3s. per square yard for first cost and maintenance for fifteen years.

(To be continued.)

DRAINING AND FILLING WATER-MAINS.

WHENEVER a water-main is extended or a new main laid connecting with the pipes already in service, it becomes necessary to empty the old main. In case of repairs, also, it often is necessary to draw off the water. In large and growing cities these cases are of such frequent occurrence as to demand due consideration in planning the water-pipe system and its extensions.

During the past year, for example, there were 621 "shut-offs" made in St. Louis for various purposes.

Large mains can generally be spared from service, but Large mains can generally be spared from service, but a few hours at most, and that only at considerable risk. In such cases it is of the greatest importance that we make such arrangement as to permit us, without fear of accident or delay, to drain the pipes, make the required connection or repairs, and fill the pipes again ready for service in the shortest possible time.

That this may be done, the first requisite is a dry point of operations. A small stream of water from a leaky stop-valve will greatly delay the work, necessitating more or less men constantly at the hand-nump or baling-

stop-valve will greatly delay the work, necessitating more or less men constantly at the hand-pump or baling-buckets, and perhaps causing caving in of the trenchanks or blowing hot lead out of the joints with the steam produced. Even tight valves will not be satisfying if we have to wait while the pipe is being pumped out before commencing the work proper, and then proceed with setting the pipes or castings in a hole lined with soft and sticky mud, ankle deep. The pipe should, whenever possible, be emptied at some point removed from the locus of the desired repairs or connection. of the desired repairs or connection.

The best arrangement for discharging the water from the main is a blow-off valve at each low point in the main

The best arrangement for discharging the water from the main is a blow-off valve at each low point in the main emptying into a sewer below.

It may be well to say in passing that the blow-off pipe should be so arranged that the stream of water from it can be seen, and thus leaks may be detected and the condition of the stop-valves during a "shut-off" may be observed. It may also be remarked that a blow-off valve should be of the best possible construction for durability and tightness, so that after being left without opening for twenty years it will work as perfectly as when new.‡

Where sewers are not available, if the streets have sufficient fall to them, a large part of the water in a "shut-off" may be discharged at the street surface. Where this is done, when it becomes necessary to drain the whole "shut-off," the adjoining "shut-off" below must be made, and the water drained off through that.

This is the method used in St. Louis for 15-inch and smaller pipes, and sometimes for large mains. Fire-plugs make the most convenient blow-offs at the streets have a good fall, and where the pipes form such a network that large and the variety and the arrange of the surety is not as the street and a stage of the streets have a

and in a city like this where most of the streets have a good fall, and where the pipes form such a network that large areas of the system could, if necessary, be emptied at one point, if a little care be taken in locating connections, valves and fire-plugs, blow-off valves may, except at a few points, be dispensed with.

Even with a blow-off at every low point in our shut-off, however, all will not be satisfactory if we have to "cut out" the pipe between a blow-off and a leaky stop-valve. The eccentricity and perversity of stop-valves are qualities much questioned by the experienced. A valve will one day leak a stream that defies hand-pumps, and the next week, perhaps, shut bottle-tight. One must be cautious,

too, about forcing them, as a broken valve might be dis-astrous. To have absolute safety from water at the point of connection or repairs, we must have a blow-off on each side of said point. Perhaps the happiest arrangement for side of said point. Perhaps the happiest arrangement for the draining of a large and important main would be to have the main valves set at low points with a blow-off on each side of each valve.

As to size of each valves.

As to size of blow-off valves, in this city 12-inch valves are generally used for 30 and 36 inch mains and 6-inch valves for 20, 15, and 12 inch mains for the sake of uniformity in castings.

What annoyance may arise from want of proper draining

What annoyance may arise from want of proper draining facilities, the following case will show:

There is a low point on the 30-inch pipe-line on Cass Avenue, west of Broadway, in St. Louis, which is not provided with any blow off, so that about ten blocks of the pipe cannot be drained. Last December an old patch on a transverse crack in this pipe gave way. There was about four feet head of water on the crack, and no way to drain ti off without cutting out. It took about 48 hours' work to make a split sleeve tight over the crack, which, could the water have been drawn off, should have been done inside of five hours. In fact, had the job been duly appreciated, a blow-off valve would have been cut in at the start. Such a delay as this omission caused would be very alarming with a very important shut-off.

Opening a blow-off valve is not all that is necessary for a quick emptying of a "shut-off." Air must be admitted at some point and displace the water to be discharged.

This brings us to the principal subject of this paper, air-

cocks or air-tans

The air-cock must serve a double duty. It must give vent to air when required, and admit air when the main is to be drained. We will first consider the air-cock as used for admission of air during draining.

Let us assume a 6-inch blow-off which would discharge under an average head of 80 feet were air admitted freely.

Assume a 2-inch air-cock at the highest point in the main. If ten feet of our head be used to force air through the If ten feet of our head be used to force air through the cock, sufficient air would enter to displace about 13 cubic feet of water per second. The remaining 70 feet of head would discharge about 13 cubic feet of water per second through the blow-off. If our main be 20 inches in diameter it will drain at the rate of about six feet per second, or a mile of pipe would be drained in less than a quarter of an hour. This is a very rough approximation, of course, as it would be difficult to even approximate closely without very complete data complete data.

To get a concrete idea of the rate of inflow of air, assume the air in the pipe to be at two-thirds atmospheric pressure. Using the formula given by Rankine for flow of air through an orifice, and the constants taken from Weisbach, we get the approximate quantity of water which would be displaced for different size air-cocks:

1/2-inch cock 1/2 cubic foot per second.
1-inch cock 3 cubic feet per second.
2-inch cock 1/3 cubic feet per second.

From this we may see at a glance that whenever one n easily spare ten feet of head to furnish air, a 2-inch cock is large enough for a 6-inch blow-off, and other sizes may be roughly tested in the same way.

In considering the inflow of air, we must remember that he water is displaced by rarified air, so that as we decrease the pressure in our draining-pipe we not only increase the weight of air flowing in per second through a given opening, but we also increase the volume of water which a pound of air will displace.

This relation of volumes should be clearly pictured in

This relation of volumes should be clearly pictured in the mind before pursuing the subject further, as it is of striking importance in the problems before us.

We shall see a little further on that as a larger air-cock is required for the necessities of filling than for those of draining, we must let the former determine its size.

When there are two or more low points in a shut-off, and hence more than one blow-off, one of them, the highest will sometimes act as an air-inlet if there he no airest, will sometimes act as an air-inlet, if there be no air-cock. In one case under the writer's notice, a 12 inch blow-off was observed to be drawing air for about an hour on account of insufficient air-openings, whereas had there been an air-inlet of the proper size at the summit, the blow-off would have been doing its proper duty, and the main would have been drained in much less time.

main would have been drained in much less time.

We have now successfully emptied our pipe, broken out and made the connection, and are ready to fill. In filling lies the danger of accident as well as delay.

When a water-faucet which has been unused for some hours is opened, a quite startling fizz-bang often follows. The phenomenon may be explained thus: By opening the cock slowly a small opening is made, large enough to let the compressed air, which has collected in the upper part of the pipe, escape at a great velocity. The water of course follows it up with nearly equal velocity to the opening, only to find the hole too small for escape. The velocity of the water is instantly checked, causing a shock or "ram."

A simple formula for water-ram in pipes has not yet

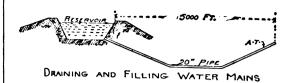
A simple formula for water-ram in pipes has not yet been published in English engineering literature. Many experiments have been made and published, but they appear to know no law. The factors of the problem seem too numerous and too hard to obtain, or what is worse,

difficult to eliminate.

One occasionally hears water-works men speak of "doubling the pressure to allow for ram."* Evidently they are considering the ram as a sudden load. A glance at the problem shows that the static pressure is a very small factor in the value of the hydraulic ram.

Mr. Fanning makes an assumption as to thetime during which the energy is expended, in estimating the ram Such an assumption, of coarse, readers the results value less except for comparison.

In order to have some conception of the force of a water-ram we will look over the following case.



Let us assume the above, supposing there to be about 100 cubic feet of compressed air in the end of our 20-inch 100 cubic feet of compressed air in the end of our 20-inch pipe, at a static pressure of 53 pounds per square inch. Now open the 2-inch air-cock "A T." The pressure of the confined air will fall about 8 pounds, due to the friction of the moving water, and we will have the air flowing from the 2-inch orifice at a pressure of 45 pounds. About 8 cubic feet per second will be discharged, as shown by our formula,* and the velocity of water in our main will hence be about 4 feet per second. Now our main will hold about be about 4 feet per second. Now our main will hold about 10,000 cubic feet of water, or about 650,000 pounds. We have then a moving energy of 325 tons at a velocity of 4 feet per second, which is equal to the energy of 81 tons, after falling I foot. Let us suppose that while things are in this condition the air-cock is suddenly closed. We will assume that only 30 cubic feet of air remain in the pipe at this instant, and that our pipe is rigid and inelastic, and therefore the whole energy of the moving body must be transferred to this compressed air, which acts as a cushion. Assuming that the product of the pressure and volume is Assuming that the product of the pressure and volume is constant, and solving graphically by an imaginary indicator diagram, we find that when 81 foot-tons of work have been done by the kinetic energy of the water in compressing the air, the final pressure will be about 200 pounds square inch, and the volume will be reduced to about cubic feet.

Let us suppose that instead of the air-cock being suddenly shut that the cock were at such a distance from and below the end of the pipe that when the rising water reaches and covers the orifice, about 30 cubic feet of air remain in the end of the main.

We would have nearly the same result as before, the only difference being the relief afforded by the 2-inch orifice for the escape of water. Had less air been left in the pipe the final pressure would be greater. This latter case must often occur in filling mains. The water is admitted too rapidly, so that the air in the main is under high pressure. the air-cock is large enough to allow air to escape in large quantities per second, but is too small to give relief to the water when the air has escaped, and often there is no air-

cushion left to ease the blow.‡

Air-cocks are usually put in at high points in the mains Air-cocks are usually put in at high points in the mains so that air accumulating in service may be released to prevent obstruction of water-way. Their use while filling the main is but incidental, and probably is not usually considered in designing the work. It may be thought by many that the cost of preparing a main for draining and filling, which are done only at long intervals, is too great for the advantages gained by such preparation; they may prefer to take the risks of damage and save the outlay. It is just as well, however, to know the factors of the problem before a decision is made. a decision is made.

The case of outflow of air from a filling-pipe is in contrast with that of the inflow in this: As we increase the pressure of the confined air we increase the promotes of air discharged per second, but we also decrease the volume which a pound of confined air will occupy in our pipe. Hence, with a given size air-cock the rate of inflow of water will be nearly the same when the confined air is at a pressure of five atmospheres as at two.

air is at a pressure of five atmospheres as at two.

If we assume the absolute pressure of the confined air which is being displaced in filling to be two atmospheres, and that said air is escaping from a 3-inch orifice, we find by our formula* that about 24 cubic feet of the confined air will be displaced by the inflowing water in one second. This would give a velocity of about 3½ feet per second in a 36-inch main or fill at the rate of a mile of pipe in about 25 minutes. We see, then, that a 3-inch tap would be large enough to fill the pipe within a reasonable time. A dangerously heavy ram would probably follow, however, when all the air had escaped.

A smaller tap would be no better unless it be so small that the velocity of the inflowing water is very low. This

that the velocity of the inflowing water is very low. This would increase the delay and loss of service, and a small air-cock has the disadvantage of giving no relief to the ram. Delay at this point is annoying, as filling the pipe

† NOTE .- The pressure due the height of water in the reservoir added to the atmospheric pressure acting through the twenty-two cubic feet will perform additional work so that the total work done in compressing the air will be over 180 foot-tons.

$$\frac{144\left(\frac{45+53}{2}+15\right)}{2,000} X_{22} = \text{for.}$$

Large air-cushions for this purpose are not altogether desirable for two reasons; First, they are too apt to increase the damage d in case of a leak or break by their explosive action; second, they bring more uncertainty into our calculations.



There seems to be a discrepancy in this estimate as compared with a subsequent report to be quoted from hereafter, showing a much greater quantity of mud removed from Piccadilly, and a much greater saving than is shown by the estimate here made for Knightsbridge, but it is given as reported.

[†] A paper by S. Bent Russell, Member Engineers' Club of St. Louis, read April 6, 1887.

[#] In a recent case of the writer's, after all stop-valves were shut, the 12-inch blow-off valve could not be opened and the adjoining "shut-off" had to be made. The whole "shut-off" necessary was thus about 10,000 feet of 36-inch pipe.

^{*} See Proc. 6th An. Meeting Am. W. W. Ass'n, p. 101.

most often comes at night, perhaps long after dark, and it is not safe to dismiss the workmen until the full pressure

is not safe to dismiss the workmen until the full pressure is on to test the new work.

A better way would be to make the air-cock larger, large enough to relieve the ram or to keep it within safe limits, and regulate the velocity of inflow at the filling-valve. An absolutely safe size for an air-cock could be found as fol-

Let Q — greatest quantity of water which could be obtained in one minute at the air-cock were air-cock as large as the main and all valves to be used in filling full open

P - maximum pressure which the pipe will safely stand.

in quantity of water which the air-cock will dis-arge in one minute with a head equal to P.

If q is made equal to or greater than Q, no damage can

In small mains and in districts where the available supply of water is not great, this safe method may be used to great advantage, even with all available valves full open for filling. The pipe is then filled in the least possible

Assuming P equal to 100 pounds per square inch and let-ting d equal diameter of air-cock in inches, the following table gives the value of q in gallons per minute for different size air-cocks:

ď	q	ď	q	ď	q
1 11/4 11/2	245 385 550	2 2½	980 1,530	3-inch fire-plug* 4-inch fire-plug*	2,030 3,600 ±

*Fire-plugs having one 3-inch nozzle or one 4-inch nozzle respect-

To show how this works out, the proper size of air-cocks for several summits in the St. Louis pipe system has been determined in this way and is shown in the table below. The available quantity of water Q was deduced from actual observations of jets from fire-plug nozzles,* and all valves were full open.

Location (Diameter of pipe in inches.	Q	Proper size of air-cock in inches.	q	
Lindell Prairie Cherokee Nat. Br. Rd. Twentieth Twentieth Sullivan Taylor Easton Finny. Page Laclede. * Broadway	Hutchinson Nebraska Newstead Cottage Obear Twenty-third Moffit Kings Highway Pendleton Prairie Jefferson Osceola	12 12 12 12 12 6 6 6 6 6 6 6 6	1,650	21/3 21/4 11/4 2 3 2 21/4 11/4 2 21/4 11/4 2 2 21/4 11/4 2 2 11/4 2 2 11/4 2 2 11/4 2 2 11/4 2 2 2 11/4 2 2 2 11/4 11/4	1,530 1,530 552 980 2,030 980 1,530 1,530 380 980 1,530
* Broadway	Osage	20	1,600	3 3	2,030

*The method of obtaining Q is hardly reliable for these large

The method of obtaining Q is hardly reliable for these large pipes.

N. B.—As this method referred to of determining available quantity of water at a point in a system of pipes is more reliable for determining the minimum quantity than the maximum, it should be used with caution in this case.

The observation for Page and Prairie was made on the 6-inch pipes at that point intended to be used in filling the 20-inch main which has since been laid on Page Avenue.

When the proper size air-cock becomes inconveniently large, two or more may be used. It is not necessary that all of these be at the summit of the pipe, provided that all are kept open until all the air has escaped that will. A fire-plug 500 feet from the summit is often used to help discharge the air and relieve the ram. In this city endeavor is made to so arrange the location of valves and fire-plugs that the latter may be used as air-cocks in filling. The fire-plug properly located is the safest, most convenient and economical air cock.

As large air cocks might be inconvenient for letting out small accumulations of air at summits during service, it would seem better to have at least two cocks at each summit in which air might accumulate, one being large for relief in filling, the other so small as to prevent a high velocity in the main to let out air accumulated in service. The latter would not be needed in every shut-off, as where the pipe system is a complete network the air accumulates

in service only at the summits of the system.

In this city it is often necessary to make the shut-off above the one to be operated upon in order to reach suit-

ably located air inlets and outlets.

In one case last year (1886) a 20-inch main was shut off and drained to make an air-inlet from a 36 6-inch shut-off, and when the work was completed the 20-inch was shut off again, to be used as an air-outlet when filling.

When we have reached the limit of size and number of air-cocks for relief, it becomes necessary to reduce our quantity Q so as to maintain the safe relation. This part of the science is usually left to the mechanics who work the valves. Too much dependence should not be placed on their judgment. If practicable, the main should be so

* See "A System of Pipes for Furnishing Water to Fire-Engines," Journal, Vol. V., No. 8.

connected that it can be filled but one way. If not, it

connected that it can be filled but one way. It not, it might be well to set apart certain valves to be used in filling a certain shut-off, and have it well understood that no others are to be opened until all air has blown off.

Large mains without side connections are usually filled through a "by-pass." The by-pass should be of such size as to fill the main at a proper velocity.* Where a main has small side connections, the neighboring pipes are generally used as a by-pass. This is saving in outlay, but has some disadvantages, such as filling the main from an undesirable point, filling too fast, and taking the pressure off the neighboring pipes.

wre off the neighboring pipes.

Water should always be admitted at the lowest point in the shut-off if possible, especially in small mains. Water admitted at top seems to interfere with the escape of air

admitted at top seems to interfere with the escape of air and cause disturbance in the pipe. It often also cuts off the air-cock and confines the air until pressure accumulates, thus losing time in filling.

The location of the main valves is a factor in the convenience of filling. The most satisfactory arrangement of a pipe-line for filling would be with a stop-valve on each summit, having a large air-cock on each side of it, and a stop-valve at each depression, with a small by-pass around stop-valve at each depression, with a small by-pass around it. Such completeness, however, would seldom harmonize with other requirements.

It often happens that a main must be filled from the highest point, thus almost necessarily interfering with the escape of air. About the only rule for this case is to avoid it, if possible.

If a by-pass is to be used for this, however, something might be done by purposely making the by-pass so small that filling may take place without disturbance.

When a shut-off is high in the middle and low at each end, it should be filled from both ends simultaneously.

Sufficient air vent for the increased rate of filling should

If such a shut-off can be filled from end only, and the air-vent cannot be exactly at the summit, it should certainly be beyond the summit; that is to say, the air-vent should not be between the inlet-valve and the summit, as it would be cut off by the rising water and the discharge of air greatly delayed.

To sum up, every well-appointed shut-off should be arranged with regard to throughness and quickness of draining, safety and quickness of filling.

In conclusion, the provisions for the convenient drain-

ing and filling of mains may appear simple enough, as stated in this paper, but when surrounded by the varied conditions of a city pipe system, they serve to sufficiently complicate the problem.

If the requirements of draining and filling are properly

kept in view in planning and extending a distribution system, greater safety will be assured and the cost of future maintenance appreciably reduced.

ELECTRIC-LIGHTING BY THE TOWER SYSTEM.

THIS question involves the following points:

First.-A form of construction of towers that will require minimum horizontal space for base, be inaccessible to boys climbing, and offer least obstruction to view along the street.

Second .- Strength to resist high winds.

Third.—Ready means of ascending to the lights, so that an attendant may care for the lamps without breaking the circuit.

Fourth.-Perfect accessibility of all parts for frequent inspection and painting.

Fifth.—The proper height for towers in order to yield the best practicable results-i. e., to enable the light to reach its effective limit without unduly robbing its immediate surroundings.

The system of electric-lighting from towers is of very recent date. Their construction has been subject to gradual change and development.

At the outset a square pyramidal to ver was most used, made with inclined posts at the corners, united by horital struts and braced both in the plane of the sides and horizontally. These horizontal braces prevented the ready arrangement and operation of an interior elevator, so resort was had to a triangular tower similarly braced on its exterior faces, but requiring no interior bracing. This left free space for an elevator, but, in order to insure strength, the tower was tapered from the top to the base, so that with an altitude of say 150 feet the spread at the base was about 28 feet.

This formed no great objection where the tower could be located in a park or unoccupied public square, but to light a city or town these towers had to be located at street corners. It was found necessary, therefore, to have the tower span the street or a sidewalk, so that one corner of the tower might rest near the corner of the street, and the two other corners of the tower rest adjacent to the buildings. This was unsightly and inconvenient, as frequently in cities the space between the sidewalk and the building is occupied by vaults or openings, and tower foundations placed there would often be very much in the way, necessitating the shifting of a tower location from a point where it ought to be to some other locality where it is possible to erect it.

Again, with a pyramidal tower not guyed, the windpressure caused great strains and required heavy members, and necessitated frequent adjustments and repairs. Assuming the same wind pressure per foot of height on the pyramidal tower as is permissible for the prismatic one, and that the former is not guyed and that the latter is perfectly guyed, then for equal dimensions the unguyed tower would be strained at least four times as much as the other for the same wind-pressure.

The development and improvement of pyramidal and other forms of tower gradually led to that here illustrated.

It is essentially a triangular prism, six feet on a side. built in 17 vertical sections, each 81/2 feet long, supported on a single base column and guyed at two points. The centre lengths of all sections are equal, and members, to a considerable degree, interchangeable.

The foundation is generally located just inside the angle of the curb at the street corner, and consists of a double platform of two-inch oak plank laid crosswise carrying a pier, three feet square, of hard burned brick set in a mortar of hydraulic cement and coarse sand; the pier is capped by a stone 3'x3'x6" that receives the base casting, the latter secured by six 11/8 anchor bolts through the masonry and bearing on an iron ring underneath the platform. A tubular column 14 feet high screws into the base casting and receives struts at the top connecting it with the prismatic tower. A light elevator platform runs in the interior of the tower and is carried by a single endless cable passing over a fixed upper sheave and a lower sheave attached to an adjustment lever, pivoted at the short end and counterweighted on the free long end; the outer part of the cable carries a counterpoise nearly balancing loaded elevator. Two stationary guide-cables pass through the car and are engaged by a clutch which holds the elevator stationary and only permits ascent or descent when released by pressure of the occupant's foot.

The towers have suitable lower and upper platforms with railings, and mast and arms for the lamps. All the compression members are of best lap-welded tubing, screwed into connection blocks of first quality malleable iron, that have ribs to which are bolted the forked ends screwed to each end of all the wrought-iron diagonal rods.

There are two sets of four guys each: one leading from a point 17 feet below the upper platform and the other from a point about 34 feet lower down on the tower. The guys are each a 17-inch galvanized wire cable, connected by a turnbuckle to an eye-bolt in an oak post 14 inches square by 15 feet long that is set vertically six feet in the ground at about 150 feet from base of tower and receives two guy robes in the same vertical plane. The iron-work is painted one coat of asphaltum, and the posts two coats

The towers are erected by first putting together the top section, then hoisting up and building on the next beneath it, and so on until completed. The weight of a complete tower, elevator, etc., including guy ropes, is about 7,200 pounds.

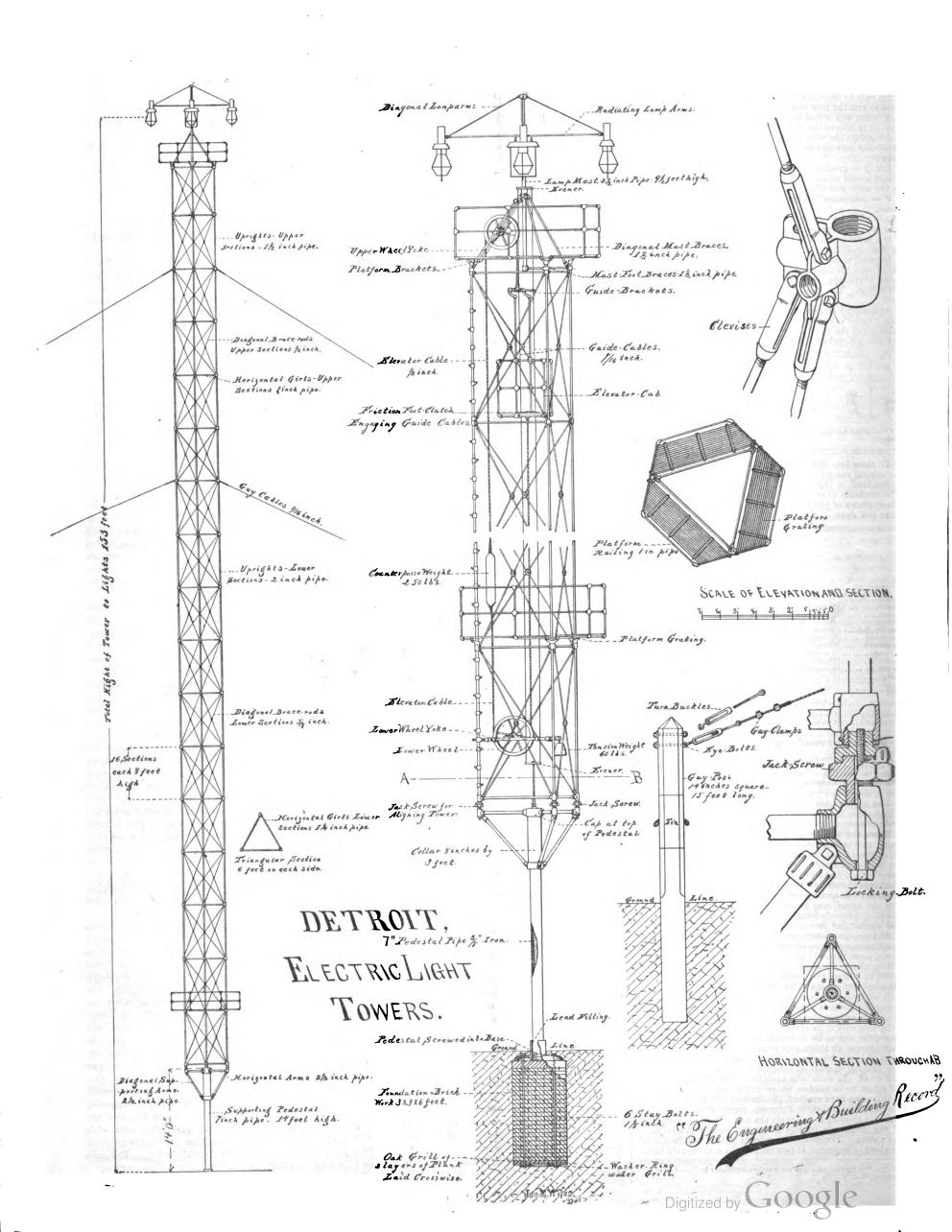
The entire wind surface, including lamps, hoods, and mechanism, is calculated at eighty-three square feet, but this should probably be increased fifty per cent. for oblique and indirect exposure.

This form of tower has been subjected to terrific storms. At Evansville, Ind., twelve of them were subjected to three cyclones, one of which destroyed large numbers of houses, barns, and shops, and, in fact, demolished some of the heavy business blocks in the vicinity of the towers. The towers were not injured in the slightest degree. The other storms were likewise very destructive of other surrounding property. They have withstood very severe storms at Detroit, Mich., where 122 of them have been in service for four years. None of them have ever sustained the slightest injury, nor have they required any repairs; not even a bolt or nut has required tightening or adjusting since the towers were erected.

In the matter of the proper height, exhaustive experiments show 150 feet to be most satisfactory. Increasing this height impairs the illumination near the foot, and does not perceptibly increase the total lighted area, while diminishing this height diminishes the illuminated area and affords unnecessary brilliancy at the base. By reason of very lofty buildings in the immediate surroundings, a height of 175 feet might be in some instances desirable.

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^{*} A 12-inch by-pass under 75 pounds head would discharge about 265 gallons per second, or fill a 36-inch pipe at the rate of five feet per second.



The towers should, so tar as practicable, be arranged in a triangular system. The distance apart in business sections may be 1,200 to 1,500 feet; in the best residence sections, such, for instance, as may be found in Detroit at a distance of half to three quarters of a mile from the business centre, the towers may be 2,000 feet apart, and in the less densely populated sections and suburbs, they may be 2,500 to 3,000 feet apart. Thus at Detroit, Mich., twenty-one miles of territory, having about 4,000 street intersections, is thoroughly and brilliantly lighted by 122 towers, and there are no gas nor naphtha lights within the corporation limits.

In a general way, towns of three to six thousand inhabitants, occupying, say, a square mile of space, may be thoroughly lighted in every quarter by seven towers, one at the centre and six at the angles of a hexagon, the towers being 2,000 feet apart.

So, also, an excellent illumination may be had by five towers, there being one at the centre and four at the angles of a square, the towers being 2,000 feet from the middle tower, and where greater economy is desirable there might be four towers, one at the centre and one a each of the angles of a triangle and about 2,000 feet from the centre tower.

In all cases it is recommended that the towers should have but four lights of 2,000 candle-power each. The central tower might have six lights of 2,000 candle-power. More lights will not materially improve the effect at a distance from the tower, while a less number of lights will scarcely afford illumination sufficient in the vicinity of the tower.

All spaces are lighted by the tower system—front yards, back yards, alleys, and streets; and in street-lighting alone the four lights on a tower will do the service which would require sixteen to twenty lights on poles, while the pole-lights will illuminate only the streets and not the yards and alleys.

A number of towers serve to produce an atmosphere of light so blended in every direction as to neutralize the shadows, so that dense shadows exist in no quarter, giving the effect of moonlight over the entire area.

The Detroit Electric-Tower Company was the pioneer in this work, and has profited in the construction of this tower by a very expensive experience. It has erected a large number of pyramidal towers in eighteen or more cities throughout North America, but since it produced this new type of tower here illustrated, based upon its large experience, it has urged them to the exclusion of all other styles, and has already erected them in Detroit, Mich., Evansville, Ind., Fond du Lac, Wis., La Crosse, Wis., Lima, O., New Orleans, La., Indianapolis, Ind., Owensboro, Ky., Council Bluffs, Iowa, and elsewhere.

It is stated that these towers, with 11,000 candle-power lamps, give an illumination at 200 feet and 1,500 feet equal to that from a gas-light at 7½ feet and 57 feet respectively, assuming the latter at the rather low value of sixteen candle-power. As these results are proportionate to the inverse squares of the distances, they are probably nearly correct, except as influenced by special local conditions.

Detroit, Mich., is lighted from 122 150-foot towers, costing, at list price, \$920 each, about \$112,000; allowing five per cent. interest and two per cent. for painting, etc., this gives \$7,840 cost of yearly maintenance. In 1886 the Electric Light Company's bid for furnishing lights was \$87,300, making total of \$97,140. The gas companies made a competitive bid of \$40,000 for the entire lighting, which was rejected.

For the drawing from which our illustration is made and the data for the above article, and for courtesies extended to our representative while investigating the subject in Detroit, we are indebted to Edward W. Pendleton, Esq., Secretary Detroit Electric-Tower Company.

CAR-HEATING FROM LOCOMOTIVE?

A MR. TURNER, of Fergus Falls, Minnesota, is said to have perfected a machine by which passenger-coaches can be heated without the use of fire, steam, or electricity, and which will not cause a fire in case of a railway accident.

We can think of nothing else except lime, or friction, or a pair of dumb-bells for each passenger, unless it be the hotwater "tomato-can" of our English friends. However, a Senator has been interested in the matter and we are promised a patent and publicity, and meantime will restrain our curiosity as best we can.



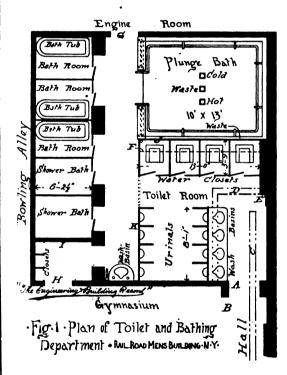
DESCRIPTION OF PLUMBING IN THE NEW RAILROAD MEN'S BUILDING IN NEW YORK.

This building is located on the north-east corner of Madison Avenue and Forty-fifth Street in New York City, adjacent to the Grand Central Depot, and was built by Mr. Cornelius Vanderbilt for the use of employees connected with all the railroads entering this depot.

The exterior is constructed of brick, red sandstone, and terra-cotta. The entrance to this building is from Madison Avenue, and the bath and toilet room is reached by a descent of twenty-one marble steps from main floor to the basement. These steps are four feet in length, and are set between two walls faced with white-glazed brick.

A ground plan is illustrated in Fig. 1 of the bath and toilet room only, which is on the side facing the railroad yard. The gymnasium is on Forty-fifth Street, and the bowling-alley is located parallel and facing Madison Avenue.

The dimensions of the bath and toilet room are 25x26 feet, with a ceiling II feet 6 inches in height. The walls of this room are faced with white-glazed brick. ceiling with white glazed tile, and surface of floor laid with unglazed tile of same color. The room receives light from three windows set near the ceiling that are facing railroad yard; but at night either gas or electricity can be used.



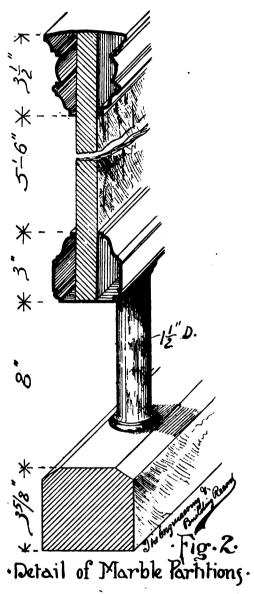
The only wood-work in this room is used for the following purposes—viz.: maple for water-closet seats; ash for doors, door and window casings and for towel-closet near door II; and cherry for window-frames.

The main entrance to gymnasium is through hall door B, but it is accessible from bath and toilet room through door II. The entrance to engine-room is through door G, and in this room is located the boiler for heating and supply of power for the pumps. There is also located here a large vertical boiler or heater containing 100 gallons, which supplies hot water for the wash-basins and for all bathing purposes required. The engineer can heat the water in this boiler by using either live or exhaust steam during cold weather; but in warm weather, when the heating boilers are not in use, a special heating device, attached to it, is utilized.

The bath and toilet room is divided into small compartments for the purposes required, as shown in Fig. 1, but the top of partitions separating these compartments does not exceed 7 feet in height above the floor, excepting one opposite H at I, which is 9 feet 3 inches in height, and consists of a brick wall 5 feet 10 inches in height above floor, on which rests a marble slab, with molding on top. shown in Fig. 2. All other partitions between compart-

ments consist of marble, light in color and one inch in thickness, and are generally made of two slabs; the principal exception being in the partition between water-closets and plunge bath at J, which consists of four slabs, each seven feet in height, and are solid from floor to tank F.

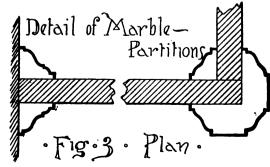
Figures 2 and 3 illustrate details of the mollings that are applied to all partitions between compartments wherever the edges are exposed, excepting the narrow slabs between the urinals, partition J, and brick wall I. These moldings are made of bronze, and a detail of section applied to top and bottom of partitions is shown in Fig. 2. The lower molding rests on bronze standards made of tubing, which are supported by a marble base 3½ inches in height. A horizontal section is given in Fig. 3, showing the molding which abuts against the wall, and a detail of vertical edge of marble partition, connected with a marble slab set between urinals at the back of wash basins



The marble partitions between water-closets are trimmed in the same manner except the rear vertical edge where the molding has been omitted. A space of eight inches between lower moldings and marble base in the partitions permits free circulation of air near the floor between each compartment at all times.

permits iree circulation of air near the floor between each compartment at all times.

A tank 13'x16' and 21 inches in height is shown in Fig. 1 at F, constructed of six marble slabs set over the water-closets, resting on the partitions. In this tank a flushing-cistern is set for each water-closet.

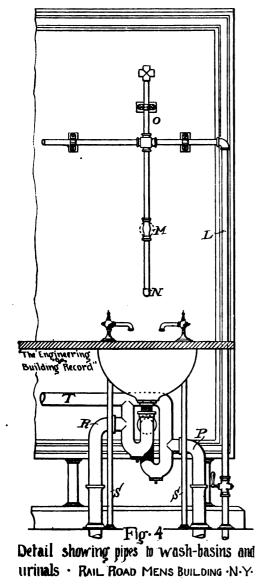


The plunge-bath is 10x13 feet and six feet in depth, the walls and bottom faced with white-glazed brick. A brass nickel-plated tube, 1½ inches in diameter, extends around the bath near the top and shaped into a ladder at one side to facilitate exit from bath.

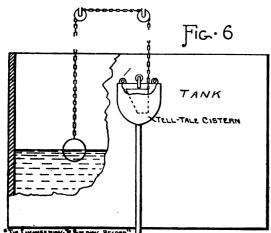


There are three compartments, each containing an allporcelain bath, and in two compartments shower-baths are provided, with fixtures to combine hot and cold water. There are four water-closets, eight urinals, and five washbasins shown in Fig. 1.

The main supply-pipe is galvanized iron and two inches in diameter, entering the engine-room from railroad yard, with a branch from it of same material, 1½ inches in diameter, to supply the compartments in bath and toilet room.



All supply and waste pipes exposed above the floor are of brass, nickel-plated. Figure 4 shows the arrangement of pipes for a wash-basin and a urinal, and each of the remaining three on this partition are arranged in the same manner. The pipe L is intended to supply water for flushing the urinals. All pipes are located on one side of this partition, as shown in Fig. 4, and therefore nothing but the urinals are on the opposite side, except a self-closing



cock over each urinal at M. The extension of supply-pipe above L at O is intended for the air-chamber to prevent hammering when stop-cock is closed quickly. At R is shown the waste-pipe from wash-basin, and S S the hot and cold supply-pipes for it, each supply-pipe passing vertically from the floor to the basin in front of waste-pipes.

At T is represented a vent-pipe two inches in diameter that connects with traps in waste-pipes from both urinals and wash-basins, and then enters a special flue in the wall, connecting with a larger pipe which extends to the roof. The pipes on partition at K are arranged in the same manner for the urinals, with a vent-pipe entering the flue described.

The water-closet seats are supported on solid brass nickel-plated standards resting on the floor and are ornamental in design; and the 2-inch back-air pipe for closet bowls is also supported on solid standards of the same material. This vent-pipe is carried to the outer wall, then passes over the front of the partition and enters a flue in the outer wall at a point above E; and in this flue a 4-inch pipe is carried up this wall to the roof, thence under corrugated tile of roof to apex, where it extends above it. The water-closets of the wash-out type are flushed by a seat attachment connected with the cistern, which is enclosed in marble.

The dotted lines at D, Fig. 1, show the line of wall for the brick vault, which extends from the point shown to sidewalk, where there is an entrance to it through a horizontal iron door in the walk, and in it are located soil-pipes and sink. This vault is five feet wide and four feet high. The construction of floor for toilet and bath room is shown in Fig. 5. The supply-pipes not exposed are galvanized iron, and are imbedded in the 6-inch layer of concrete. The supply-pipe from main in engine-room is 1% inches,

bottom of plunge-bath, a lower waste is provided for removal of water in plunge-bath below waste Y, shown in Fig. 1 at centre of bath, extending under bath from this point to a cesspool in engine-room.

The floor of engine-room is about six feet below bath and toilet room, therefore on a level with bottom of plunge-bath. This cesspool is eighteen inches in diameter and three feet deep, and therefore, to remove the water from it, a syphon is formed with a pipe one inch in diameter that connects at apex with a 3-inch blow off pipe from boilers, and is two feet below floor of bath and toilet rooms at point of connection; thence running to a low point in the 6-inch soil-pipe, connecting with it near the outer wall on Forty-fifth Street. As this syphon changes at its highest point from I inch to a pipe 3 inches in diameter, a loss of head will occur and therefore sometimes fail to work, and to overcome this a special device has been fixed in the cesspool to utilize either pressure from water-supply or steam for that purpose, utilizing the former to charge the pipe.

The janitor's quarters are located on the third floorand are provided with a kitchen in which is located a range, boiler, sink, and wash-tray; also a bath-room in which is located a porcelain bath-tub, water-closet, and two wash-basins, each being provided with the same elaborate style of fixtures previously described. The water-supply from janitor's room is obtained from a tank near the roof, 4x6 feet and 4 feet high, holding 490 gallons of water.

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with branches to tub and shower baths, each being one inch in diameter; and the branches to flushing-cisterns, row of wash-basins, and each row of urinals are one inch also. The plunge bath is supplied direct from main in engineroom, connection being shown near centre of bath in Fig. 1; and the diameter of these supply-pipes is two inches.

A 3-inch waste-pipe branches from soil-pipe C and runs to compartments containing wash-basins and urinals, with 2-inch branches from it of lead, which connect with the brass waste-pipes previously described, below the layer of broken stone.

The branch soil-pipe X from the water-closets enters 6-inch drain-pipe, as shown in Fig. 5.

The floor of each compartment containing tub and shower baths have separate waste-pipes of lead, two inches in diameter, leading from them to vault, and there discharge into a sink, as shown in Fig. 5.

The ground under the main building is sub-drained with tile three inches in diameter, laid below the course of broken stone, with spaces of six feet between each line of pipe, and they discharge into vault. This vault has a separate connection with sewer, which is trapped. The side walls are built of brick, and bottom of concrete.

The overflow and waste pipe from plunge-bath is shown at Y, and in it is set a valve E, with handle extending up through floor at E, shown in Figs. 1 and 5. This 3-inch waste changes to a 4-inch before connecting with trap under sink, and in this 4-inch pipe a bick-water valve is set, which is shown at V, preventing any water flowing from sink to plunge-bath when the valve E is open and bath empty. The top of waste-pipe Y is about on a level with drain-pipe, but shown in drawing above to represent detail clearly. As this waste is about six inches higher than

This tank is provided with a special device, shown in Fig. 6, to warn the engineer not only when the tank is filled, but also when it requires refilling. An automatic flushing cistern is secured to one side of tank, and a 14-inch tell-tale pipe extends from it to engine-room, with a pipe from tank which will discharge into tell-tale cistern. This cistern is adjusted to dump automatically only when water in tank falls to within one foot of bottom. A chain is attached to one side of cistern and carried over tank suspended on pulleys, as shown, with a float on opposite end. This chain is drawn taut whenever water in tank falls to the point stated; then the weight of float dumps the cistern, causing a rush of water do an the tell-tale pipe. warning the engineer. When tank is refilled by pumping, the overflow fills this cistern, and runs down tell-tale pipe, notifying the engineer that tank is full.

The master plumbers were Messrs. Mead & Rossman' and the architects Messrs. R. H. Robertson and A. J. Manning, all of this city.

Correspondence.

All correspondents should s-nd us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

WHY DO STEAM-HEATING CONCERNS CON-DEMN THE ONE-PIPE SYSTEM OF STEAM-HEATING?

WORCESTER, MASS., December 19, 1887.

SIR: Why is it that so many steam-heating concerns condemn the one-pipe system of house-heating in every case, and will not acknowledge that it ever does, or can work satisfactorily, when it is well known that it works all right in many cases?

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Of course, it is plain to every one that two pipes are indispensable in any large building when heated by a high-pressure steam-heating boiler.

But there are many small or medium-size dwellings,

But there are many small or medium-size dwellings, with about five to fifteen radiators, heated with some of the various low-pressure apparatus, which have but one pipe, without even drip-pipe at foot of risers, and work all right, without any noise or any trouble whatever.

The writer of this is familiar with a number of such cases, and cannot see why it should be so utterly condemned, when it is simpler, and saves some expense, without any apparent disadvantage.

without any apparent disadvantage. INCUIRER

[We are not aware that the one-pipe system of conveying steam from boilers to radiators is unqualifiedly condemned. With certain good radiators, and in the hands of careful fitters, very good results are obtained. With it in buildings that cover a good of ground, it is often at a disadvantage, however, when contrasted with the twopipe system. For instance, every coil or radiator will work with an inlet-pipe for steam, and an outlet-pipe for water, and but very few coils will work with a single pipe for both purposes. Nearly all the modern radiators will work under one pipe if it is of large diameter; still there are some that will not, and these must have a return pipe.

One decided disadvantage the one-pipe and one-valve apparatus has is its great tendency to make noise when steam is let on a radiator, and its slowness to expel water when the radiator is once full. Let a radiator with a single pipe be shut off carelessly—that is, not tightly closed—or let there be a leaky valve to it so the radiator will condense itself full of water, then upon opening the valve there will be from 10 to 30 minutes of the most frightful racket experienced—technically known as waterhammer-before the statu quo is established, and the affairs of that household go in anything like harmony again.

The system is, however, between 5 and 10 per cent. cheaper than the double-pipe system, and where it can be used we see no very great objection to it, provided the persons who are to use it are not led to believe it is the

DANGEROUS HIGH-PRESSURE HOT-WATER APPARATUS, INDICATING RATIO OF DAN-GER WITH ORDINARY EXPANSION TANKS SHOULD THEY BE CLOSED, WITHOUT A SAFETY-VALVE, OR IN SUCH A MANNER THAT THE SAFETY-VALVE CAN BECOME INOPERATIVE.

-, December 12, 1887.

SIR: I have a few questions I would like your opinion on. A gentleman persists in running his hot-water apparatus under extra pressure, the result being that he has broken his boiler twice. He admits that he is running under considerable pressure, and cannot seem to see the desirability of doing the work under the pressure of

the water only.

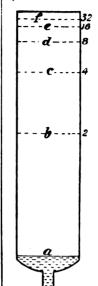
My first question is this: We will assume a low-pressure hot-water job, with the expansion tank open to the atmosphere, and that the tank is 24 feet above the heater, giving a pressure,say.of 12 pounds to the square inch. Now, suppose a safety-valve is put on this tank, and it closed to the atmosphere, and the ball on the lever of the safety-valve run out to 5 or 10 pounds, what extra pressure would there be on the apparatus, over and above the column of mater, when the valvance cet as above prestread. umn of water, when the valve was set as above mentioned?
(2) Suppose the safety-valve became corroded and stuck, what, in your judgment, would be the most pressure they what, in your judgment, would be the most pressure they could get on the job? (3) I would also thank you to give me the different pressures, supposing the tank to be set, say 20, 30, 35, 40, 50 and 80 feet above the heater, and closed to the atmosphere? Of course, I am aware what the pressure of the hydrostatic column of water is at the different heights, but what I want to get at is the increased pressure by closing the tank to the atmosphere when the tank is placed at the above-mentioned heights above the

[(1) The greatest possible additional pressure that can result where a safety-valve is in good order will be the original head of water in pounds, plus the pressure the safety-valve is set for, which, in this case, would be 12 + 10 = 22 pounds.

(2 and 3) If the safety-valve became corroded and will not lift there is no estimating the pressure for general conditions. It would be simply a 20, 40 or 80-foot head, plus the unknown quantity, which latter could readily reach disastrous dimensions, unless the closed expansion tank was much larger in capacity than ordinary practice.

We will add, that unless the water in an apparatus is to be carried above the temperature of 212° Fah, nothing can be gained by using a closed tank. The circulation will be no faster thereby, and for house-apparatus this practice should not be tolerated, as it makes an apparatus, which is otherwise absolutely safe, dangerous, and liable to burst and scald people.

To see this in its proper light, what we have to consider is to imagine an ordinary apparatus with an expansiontank one-twentieth of the whole capacity, or sufficient to take care of the increment of the expansion of water from 40° to 212° Fah. If we close this tank so the air cannot



escape, the accompanying diagram will show the additional increment of pressure, caused by the expansion of the water and the compression of the

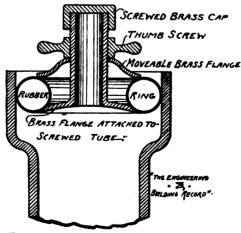
When the water is at a the water in the apparatus is cold, say with a temperature of 40° Fah. When it is warmed to about 155° it rises until it reaches the position b, or half-way up, and has compressed the air above it until it has a pressure of two atmospheres. At a temperature of about 185° it is at c, and the pressure of the air is four atmospheres; at 200°, or thereabouts, it reaches d, and the pressure is eight atmospheres, and at e, sixteen atmospheres, and at f, thirtytwo atmospheres, or 480 pounds pressure per square inch, and, as yet, the water has not reached a temperature of 212° Fah.

With a tank of twice the capacity, of course, the danger is very much lessened, as then one extra atmosphere only can be added to the pressure caused by the water-head for a range of temperature between 40° and 212°, but the danger still continues beyond 212°, and, therefore, the practice should be condemned; and where high temperature is an absolute necessity, the designing of such an apparatus should only be entrusted to one thoroughly conversant with the subject.]

PLUG FOR TESTING SOIL-PIPES.

MONTREAL SANITARY ASSOCIATION. Standard Buildings, St. James Street, MONTREAL, I'ecember 19, 1887.

SIR: With reference to the inquiry of "Subscriber" about plugs for testing drains or soil-pipes, I may state that I daily use a rubber device which I find most satisfactory. I use it for applying the "smoke test," but it was designed to withstand water-pressure. It consists of was designed to withstand water-pressure. It consists of a rubber ring placed between two brass flanges which can be squeezed together by a thumb-screw after the ring has been inserted in the pipe, so as to make the ring fit very tightly. A different size of ring is required for each size of pipe, but one pair of flanges does for several sizes of rings. The device is something like this in section.



PLUG FOR TESTING SOIL PIPES

When applying the smoke test the cap is omitted and a rubber hose is attached by means of a coupling.

These rings and flanges, etc., I bought along with a smoke-resting machine from Messrs. Burn & Baillie, plumbers and brass workers, Hanover Street, Edinburgh, Scotland, who are the makers.

I am, yours truly,

RICHARD P. FLEMING, M. Can. Soc. C. E.,

Engineer of the Montreal Sanitary Association.

A COURSE IN SANITARY ENGINEERING.

TUBBSVILLE, O., HENRY Co., December 16, 1887. SIR: Will you please give me some information on learning sanitary engineering, and as to the best place for such a course, and oblige,

ALFRED S. TUBBS.

[Columbia College, New York, has a regular four years' course, and confers the degree of sanitary engineer.]

THE "ENGLISH WAY" OF CAR-HEATING.

THE Buffalo Courier quotes a refined tourist as saying: "So Charles Dickens doesn't like the way we heat our railway cars. We really must adopt the English way. And what is that? Why, a rather large flattened tomatocan is filled with hot water and put on the floor of the carriage and you're supposed to keep warm on it. The only way to g t any warmth out of it at all is to hold it on your lap and then your back freezes. One of these hotwater cans is expected to keep you warm for twelve hours. It gets stone cold within two. and ice-cream may be kept from melting on it. If our English friends don't admire from melting on it. If our English friends don't admire our way of heating cars let them go home."

Perhaps, however, Mr. Dickens was right after all, for even a cold "tomato-can" will, in case of collision or derailment, be preferred to the warmest car-stove by all who are not partial to ante-mortem cremation.

By the time Mr. Dickens next visits us we hope that car-heating from locomotive will have made such progress as to reconcile him to the American way.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York	Manhattan	Mctropolitan	Mutual	. Municipal	Krickerbocker	Equitable
	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Cas-Light	Gas-Light	Gas-Light
	Company.	Company.	Company.	Company	Company.	Company.	Company.
December 17	23.25	18.62	20 47	29.62	27.82	25.32	31.13

COMPARATIVE COST OF GAS AND ELECTRIC LIGHTING OF GRAND CENTRAL DEPOT, CINCINNATI.

MR. JOHN W. HILL, M. E., Professor Thomas French, Jr., of McMicken University, and C. E. John, electrician, were recently employed to test and report on comparative cost of lighting the Grand Central Depot at Cincinnati by gas and incandescent electric light. The electric light being charged with cost of steam to run the dynamos, the result was in favor of gas. General Hickenlooper, the President of the Gas Company, offers to enter into a contract with depot owners "for any desired number of years to light the entire premises with gas and guarantee that the degree of illumination shall in no case be less than that now afforded by electricity and charge forty per cent. less than the incandescent lighting cost last year.

TELEPHONES FOR BUENOS AYRES.

A COMPANY in Buenos Ayres has recently ordered the material for a complete system of telephones from the Société Générale de Teléphonés at Paris. Annales Industriclies states that over two thousand subscribers have been obtained, and the company proposes to erect a tower in the river, which will serve as a maritime telephone station. The harbor of Buenos Ayres is shallow, so that vessels are obliged to anchor several miles from the city. Telephone communication by means of a tower near the anchorage will be serviceable.

ELECTRIC CAR-LIGHTING IN RUSSIAN TUNNELS.

Annales Industrielles gives an account of a method fo lighting the fast trains from Kieff to Odessa, in Russia, by means of electricity. The object is to light the cars during the day while passing through tunnels. The plant consists of a powerful Crompton compound dynamo machine, which supplies a current of 110 volts electromotive force. There are three circuits of 2,000, 1,460, and 6,540 feet respectively. The rails are used for the return conductor, and the other wires are laid in a central tunnel between the tracks. Contact is made in each tunnel with the wire for that circuit by contact pulleys on the car axles. Each car has its own contact with the wire, so that all complicated connections of coupling a train are avoided. The train may stop while in the tunnel and the system will continue to operate. The company has applied the system to seventy-four cars, and they report that the expense of the system is less than one-third the cost of gas.

THE NEW ELECTRIC RAILWAY FROM BROOK-LYN TO JAMAICA.

THE Jamaica and Brooklyn Road Co., owning the old Jamaica Plank Road, have just finished and put in operation an electric railway to take the place of the former horse cars. It extends six miles from the Alabama Ave-



nue station of the Brooklyn Elevated Railroad at East New York to the town of Jamaica, and is operated on the "Van Depoele system." The electric-power station is at Woodhaven, about midway on the road. The track is single, with turnouts. The electric power is generated by a 175 horse-power compound engine, made at the Putnam Works, of Fitchburg, Mass. The plant is arranged to sup; ly light as well as tractive power at all points on the line of the road. The Van Depoele Electric Generator is a series wound dynamo of 100 horse-power and makes 500 revolutions per minute. The exciter, which regulates the power, is of about eighthorse-power and makes about 1,400 revolutions per minute.

The power is transmitted by two 3/8-inch copper wires. stretched over the centre of the track to the cars by means of "travelers," or brass wheels, with plumbago bearings, running on the wires, and attached by 3/8-inch insulated copper wires to the fifteen horse-power electric motor in a closed compartment on the front of the car. On the motor shaft is a pinion, which drives a larger gear on a steel countershaft, on each end of which is a sprocketwheel and by means of two steel chain belts motion is communicated to similar wheels keyed on the front axle of the car. On the trial trip the car, making three short stops, ran 21/2 miles in twelve minutes. The ordinary time will be twelve miles an hour, with trips every three hours at a cost for power of \$1.40 per day for each car. The entire electrical apparatus is furnished by the Van Depoele Company. The cars, which seat thirty people and are lighted by Edison incandescent lamos from the overhead power wir s, are built by the Pullman Company. Large cars or small trains will be drawn by separate motors. Aaron K. Styles has leased the road from the Road Company for the term of its charter, which is ninetynine years. William M. Scott is the Superintendent and Vice-President.

Roads are said to be successfully operated on the Van Depoele system at Binghamton, N. Y., Scranton, Pa., and in several Western cities.

THE BOSTON SOCIETY OF CIVIL ENGINEERS.

AT the regular meeting of the Boston Society of Civil Engineers, 21st inst., President L. F. Rice in the chair, a paper prepared by George A. Ellis, giving a description of the Racine Water-Works, was read by the secretary and discussed by members. Mr. M. M. Tidd gave a description of the Simpson Dry Docks, New York. Twenty-six members present.

THE ENGINEERS' CLUB OF ST. LOUIS.

THE club met December 7, President Potter in the chair, William H. Bryan, Secretary; twenty-nine members and three visitors present. Reno DeO. Johnson, Oscar W. Raeder, James C. Simpson, and Albert H. Zeller were elected to membership.

The following nominations were made for the coming year: For President, M. L. Holman; Vice-President, J. A. Ockerson; Secretary, William H. Bryan; Treasurer, C. W. Melcher; Librarian, J. B. Johnson; Directors, William B, Potter and F. E. Nipher.

President Potter read the report of the Executive Committee, which showed the club to be in a prosperous condition. P. M. Bruner then read a short paper on "The Action of Frost on Concrete Work." He explained the difficulties met with, and reported the results of a series of experiments he had made on Portland cement; also offered suggestion for counteracting the influence of low temperatures. He said the addition of salt would lower the freezing point one degree for one per cent. addition up to the point of saturation, and would also increase the tensile strength. The discussion proved very interesting, those participating being Robert Moore, J. A. Seddon, Wheeler, Professor Johnson, Ockerson, Macklind, Flad, Holdman, and Caldwell. But little reliable data was to be had. Professor Johnson offered to make a series of tests. It was shown that the best work was secured between the temperatures of 45° and 70° Fah.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING was held Wednesday evening, December 21, and, in the absence of the President, Mr. W. R. Hutton occupied the chair. Announcement was made that the annual meeting would be held on Wednesday, January 18, when officers would be elected and the place of the next annual convention decided upon. The secretary

stated that an invitation had been received from Milwaukee inviting the society to hold its next annual convention in that city.

On January 10 various points of interest about the city would be visited, and among them the new bridge crossing the Harlem River, to which the society was invited by the engineers in charge.

Then followed the paper of the evening on the Venturi water-meter, of which an abstract is given below.

An interesting discussion followed, which was participated in by Messrs. Flagg, Church, Emery. Streidinger, Closs. Brinckerhoff, North, and Brush, the general opinion being that the new device promised to be of great value.

THE VENTURI WATER-METER.

BY CLEMENS HERSCHEL, M. AM. SOC. C. E.*

Some additional instrument or method for gauging water has long been desired by hydraulic engineers. In the case of water flowing through pipes, as in city waterworks, it is exceedingly difficult, or impracticable, to meter the water, as soon as diameters approaching one foot or quantities approaching a million gallons daily are reached. In some such cases the stream of water has been split up into many smaller ones, each of which was then furnished with a meter, and the tail-water of these meters reunited; a method and apparatus so cumbersome and costly as to be rarely applicable. Taking the case on the other hand, and of a far less valuable commodityviz., of water under little or no pressure, about to be, or after it has been, used for power, the practical difficulties of gauging again become very great. Ordinary meters are out of the question, owing to the small value of the article per cubic foot, and to the proportionately great cost, per cubic foot of water metered, of applying a mechanical meter. Still, an approach to metering the water is found when the turbine or other water motor is converted, by previous tests or experiments, into a form of water-meter; and this method is doing excellent and extensive service for many water-power companies. In mills that use cheap wheels, and change their wheels frequently, it causes considerable work and expense to maintain the water-wheel system of measurements.

The weir is seldom permanently applicable to such cases, on account of the difficulty and expense of setting and maintaining it, and because it diminishes the head acting on the wheel. If put up stream from the wheel it must take the form of a movable weir, sliding up and down in grooves. The weir edge is then raised or lowered until the quantity passing the weir is just equal to the draft of the wheel; a delicate operation, and applicable only in the case of experiments where the engineer has full control of the wheel.

The writer refers to experiments made by Mr. James B. Francis, Past President of the Society, some thirty years ago, and also the method described in the Transactions of the Society by A. Fteley, M. Am. Soc. C. E., and then remarks: "It has long seemed to me that the use in metering water of the principle involved in the Bourdon anemometer an instrument, which has been used to measure the velocity of currents of air in mines, in France, would yield valuable results, and the present paper is intended to record the experiments made and results found with two sizes of water-meters of that description. Bourdon's anemometer is founded upon the property of a Venturi tube to exercise a sucking action through holes bored into its narrowest section. Then, by measuring the intensity of this aspiration by means of any form of vacuum gauge, and establishing the relation between such vacuum pressure and the velocity of the air through the tube, the instrument becomes an anemometer. This described property of the Venturi tube was known to Venturi, who made experiments with it in Modena about 1791. But Venturi suggests no use for it, as with him it was merely a curious phenomenon in the working of his apparatus.'

The writer details at some length the experiments made by others embodying the principle of the Bourdon anemometer, and then gives a long and interesting detailed description of his own experiments, which would require to be given in full to make it intelligible.

* Abstract of a paper read December 21, 1887, before the American Scc.ety of C.vil Engineers, on an instrument making use of a n-w method of gauging water, applicable to the cases of very large tubes, and of a small value only of the liquid to be gauged.

He states in conclusion that, "writing only a few weeks after the close of the second set of experiments, I very likely do not allude to all the capabilities of the meter. It seems to me it may, in many instances, replace the use of a weir, being more easily applied and equally accurate, and it can be used where a weir is entirely inapplicable. There is the promise of a great and varied usefulness in the Venturi meter."

The meters above mentioned were applied to pipes of a diameter of twelve inches and nine feet respectively, the diameter at the "Venturi" or narrowest portion where the vacuum gauge is attached being one-third of the diameter of the pipe in each case.

The coefficients in the different experiments differed by only a few per cent., showing the apparatus to be very satisfactorily accurate, although in the large meter the discharge sometimes exceeds 250 cubic feet per second. Mr. Herschel stated that, although he had patented the apparatus, he would be glad to give the right of use free to any one who would carefully experiment with it and inform him of the results.

THE INFLUENCE OF SUGAR UPON CEMENT.

ALTHOUGH the use of sugar to increase the strength of cement has been an immemorial custom in India, the subject has had additional light thrown upon it by experiments made by Mr. Harry De B. Parsons, M. Am. Soc. M. E., assisted by Mr. Henry Hobart Porter, Jr., E. M., and detailed in a recent paper before the American Society of Mechanical Engineers.

The first experiments were made with refuse molasses from a sugar-refinery, I per cent. being added to 35 per cent. of water by weight, for gauging the cement; the cement used being the Dyckerhoff Portland.

As compared with a mixture of neat cement the increase in strength was much less rapid, and up to three months had not obtained the same strength; the strengths being 353½ and 456½ pounds per square inch respectively. Mixture containing molasses showed, however, a tendency at that age to increase in strength more rapidly than the other.

As there were practical difficulties in the use of molasses owing to the rapid chemical changes in the mixture, additional trials were made with pure crystalline sugar. These were made with both the Dyckerhoff and the F. O. Norton Rosendale cements.

In the latter case 40 per cent. of water was used. All results are averages of three or four samples, and they are given in the following tables:

TESTS WITH DYCKERHOFF CEMENT (PORTLAND).

Time of Tests	Day.	Days.	Week	W'ks.	w¹ks.	Mo's.	Mo's.	Mo's.
Neat	701/5	160	2983/3	383	436	446	45634	485¾
With 1/4 % of	9	 	511/2		480	 .	52234	565¾
With 1/2 % of	43/6		413/3	 	411	•••••	552¾	ļ
With ½ % of sugar With I % of	2		341/2		ļ	ļ	52734	5713
sugar	2		47	 -	4031/2		5723/4	ļ
With 2 ≸ of sugar			50	ļ . .	334		537%	

TESTS WITH F. O. NORTON'S ROSENDALE CEMENT.

TIME OF TESTS.	Day.	Week.	2 Weeks.	Weeks.	Months.	Months.
Neat	001/	251/3	62 27	74 99 76	225 1/2 243 3/4 238 154 3/4	255 ½ 230½ 301½ 264 181¾

The manifest effect of the saccharine matter is to retard the setting of the cement; and the subsequent excess of strength the authors judge to be more mechanical than chemical, the sugar by this retarding effect giving time for the chemical changes to take place more perfectly.

The greatest increase of strength seems to result by the addition of ½ to ½ per cent. and the maximum excess to be about 20 per cent. This very slow initial setting will undoubtedly prevent the process from coming into use; and if it be true, as is stated, that the sugar seems still to exist in a crystalline state in the interior of the specimens, the gain of 15 to 20 per cent. is probably only apparent, and the cement would be equally strong without the sugar after the lapse of sufficient time.



TRESTLE ON GRILLAGE OVER HANOVER POND, CONN.

This trestle was built by the Berlin Bridge Co., of East Berlin, Conn., to carry a single-track line of the Meriden and Waterbury Railroad. It is of the ordinary type of plumb and batter post bents, braced both ways, noticeable only on account of the efficient way of securing good foundation in a bad bottom with cheap, common materials.

The water was still and shallow, and the bottom soft, treacherous, and of unknown depth. The ordinary mud-sill would not answer and a pile-driver could not be conveniently secured nor piles economically used. The Bridge Co.'s superintendent in charge, Mr. J. Devin, devised the expedient shown. Several car-loads of sound, hewn railroad ties were ordered, regularly arranged about fifteen inches apart on a level place, and factened by two 3x10-inch binder-planks spiked to each tie. This grating was floated to required position, and the corresponding bent, framed into a bottom sill, slid on to its centre line and heeled up vertical in the usual manner, braced to the preceding section, and so on for the next. The sill of the bent simply rested on the grating without any fastening whatever. Its weight submerged it and fixed it in the bottom, and the structure stood plumb and firm, kept straight and square under train load with scarcely perceptible settling

A CORRECTION.

THE OLD CHURCH AT BORGUND, NORWAY.

BOSTON, December 19, 1887.

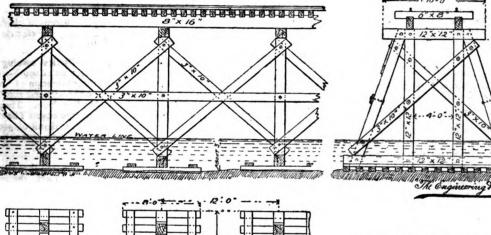
SIR: In your issue for December 17, just come to hand, the illustration is labeled Old Church at Bergen, Norway. It should be at Borgund, Norway, as you doubtless have been told a score of times before this.

Very truly, ELLEN H. RICHARDS.

THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

The regular meeting of the society was held at Pittsburg December 20. President Alexander Dempster called the meeting to order, and the following gentlemen were elected to membership: Charles I. Traville, Lewis C. Weldin, H. Ward Verner, Frank Felkel, J. P. Daine, G. M. Engel, L. H. Simpson, and H. C. Campbell.

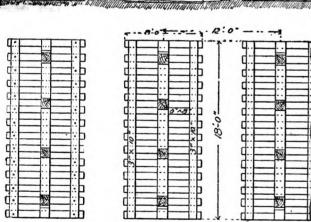
Mr. W. Lucien Scaife, as chairman of the committee, which included also Messrs. Charles Davis and Charles Ehlers, instructed to investigate into the Fort Wayne accident, and to report upon a method of avoiding such an accident in the future, then read the report of the committee, which was accepted and filed, and the Secretary was instructed to send copies of the report to Councils and the different railroads.



TRESTLE ON GRILLAGE

HANOVER POND, MERIDEN, CONN.
N. Y., N. H. & H. R. R.

NOTE.—Vertical and batter posts connected with mortise and tenon joints and 2-inch pins. All brace plank bolted on with 3/-inch bolts.



HORIZONTAL SECTION JUST BELOW WATER LINE

under the first application and none afterwards — It gives perfect satisfaction under constant traffic. One bent was put in with the binder-planks underneath the ties, but, owing to a slight current or springs in the bottom, it was quickly undermined by a channel its whole length. By turning the grating, the other side up however, the difficulty was entirely obviated.

Der Praktische Maschinen Constructeur says that Dr. Bernadon, a Russian physicist, has recently discovered a method for welding iron with other metals by means of electricity. It is claimed the difficulty hitherto has been to obtain sufficient current strength. Dr. Frank referred to this difficulty in a lecture before the Polytechnical Society of Berlin in view of the fact that lightning-rods of any considerable thickness are never fused. Sir William Thompson also failed to solve the problem satisfactorily. Dr. Bernadon, it is asserted, has succeeded by a comparatively simple method. He uses large machines of 20 to 25 horse-power to charge a storage battery, and uses the stored energy at the desired moment. He has not only welded iron upon iron, but iron with steel, copper, and bronze, and makes a practically perfect union. A company at Rixdorf, near Berlin, are building a plant to use this method.

[We believe all this was shown at the recent fair of the American Institute in New York City.—ED.]

This committee finds that the grade crossings, or the bulk of them, are serious and dangerous obstructions, and that they should be dispensed with.

They are of the opinion that the proper way to relieve the Fort Wayne Railroad crossings on the principal thoroughfares in Allegheny and in Pittsburg is by elevating the tracks of the Fort Wayne Railroad with its connection, the West Penn Railroad. The clearance height of the railroad at street crossings should at least be 13½ feet.

By such an elevated road the Fort Wayne and West Penn will be greatly benefited by the increased facilities afforded in the running of trains, the handling of freight and passengers, and in other respects in being relieved of the expense of flagmen, gatekeepers, and the liability for damages by accidents at gate-crossings. The cities will be the gainers by reason of relief from danger, and interruptions at crossings, and the enhancement of the value of property along such lines.

The length of lines to be changed is about two miles, and even if the cost should reach \$1,500,000, it would not be an unreasonable project, considering the benefits to be derived by the railroad and cities.

A discussion, the principal points of which will be given later, followed on Mr. Ramsey's paper on "The Effect of Temperature on Structural Iron and Steel." of which we gave an abstract on October 29, during which an interesting chart was shown, giving the number of rails broken

in winter as running above 100 a month and in summer being as low as three.

W. T. Scaife was then nominated to succeed M. J. Becker as Vice-President, T. P. Roberts to succeed Mr. Scaife, and Charles Davis and W. C. Phillips as directors.

AS TO PRICES OF PORTLAND CEMENT.

(From the London Times.)

THE Hamburg Borsen Zeitung, in discussing the question frequently raised of late, whether the present movement in Portland cement is transient or whether the prospect for the ensuing year is favorable, says: "Significant indications are given by the result of the public competition which took place in Posen on the 2d of this month for the large quantity of 85,000 normal tons. This cement was ordered for use on the royal fortifications, and is deliverable in the period from now to June, 1889. The tenders submitted by ten manufacturers are, on the average, after allowing for transport charges, 13 per cent. higher than those of June 2, obtained by the same department for 18,000 normal tons. Especially significant is the fact that the lowest tenders of November 2 are about 23 per cent. above the lowest of June 2."

THE Royal Institute of British Architects have instituted an admirable competition, to be held next year, with a view to encourage the study of stereotomy. The subject of the competition will be "The Vaulting of an Angle of a Cloister," to be shown by a model and working drawings. It will be an open competition, and a special class for instruction in stone-cutting will be opened under Mr. Harvey in connection therewith. The institute gives notice that the models will probably have to be constructed in the rooms of the institute and in the presence of moderators representing the council.

THE electric street-car fitted up by the Weston Electric Light Company, that has been traversing the Cambridge roads for the last six months or so, made its first appearance on Boston streets the other day. It is driven from a Julien storage battery, and surmounts the steepest grades with ease. It will soon be used for regular trips between Boston and Harvard Square.

A PROMISING coal-mine has been struck at Jordan, Scott Co., Minn.

A saw-MILL boiler exploded December 13 at Mt. Sterling, Ky., killing the sawyer and badly injuring the engineer. It weighed four tons and was thrown 125 yards, demolishing in its flight part of a machine shop and tearing up a railroad track. Cause, low water.

JOHN C. COCHRANE.

JOHN C. COCHRANE one of the best known architects in Chicago, died at his residence December 14, after an illness of but six days. Born in New Boston, N. H., November 8, 1833, after receiving an academic education he came to Chicago in 1855, and was employed for some time in an architect's office. A year later he opened an office in Davenport, Iowa, and for the next two years designed most of the principal buildings erected there. In 1864 he came to Chicago to reside permanently. He made a specialty of public buildings, and the North-west is dotted all over with monuments to his professional skill. In Chicago the structures with which his name is most prominently connected are the Chamber of Commerce, the Cook County and Michael Reese Hospitals. Rush Medical College, First Presbyterian Church, Jefferson Park Presbyterian Church. Church of the Messiah, and Central Baptist Churcn. Besides these public buildings he designed a large number of private residences in the city. He was twice married, and leaves three children.

Mr. Cochrane died of nervous prostration. He was sick but a short time, and his illness was not regarded at first as at all serious.

PERSONAL.

MR. HAROLD PETO, of the firm of London architects. Ernest George & Peto, is now visiting the United States and inspecting buildings and American methods of construction.

CHESTER B. DAVIS, of Chicago, and Colonel H. Flad, of St. Louis, have been appointed as consulting engineers to assist Special Engineer Whitman in his duties of planning for the intercepting sewers of Milwaukee.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

MINNEAPOLIS, MINN.—The time for receiving competitive plans for the new Court-House and City Hall has been extended to February 15, and the size of the stretchers may be increased to 48x48 and 55x55.



For works for which proposals are requested see also the "Proposal Column," pages i-iv-64.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and rel able news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

SALEM, MASS.—The water board, in its annual report, will recommend the building of a main around through Danvers in preference to building a reservoir on Gallows' Hill.

RIVERSIDE, CAL.—This place has water bonds in the sum of \$150,000 for a water company to make improvements and extend the water privilege.

NEW ROCHELLE, N. Y.—The Manhattan Life Insurance Company has made a contract with the New Rochelle Water Company to supply Rochelle Park with water.

GRAND RAPIDS, MICH.—The proposition to bond this city in the sum of \$250,000 for extending the water-works system was lost at the recent special election.

WILMINGTON, N. C.—Concerning a report that the water-works company at this place were to sink several artesian wells, our correspondent writes as follows: "No action taken, nor is any contemplated at present."

NEW YORK CITY.—At a recent meeting of the Aqueduct Board the plans of the Quaker Bridge Dam and Reservoir, presented by Chief Engineer Church, were accepted, and the Chief Engineer was directed to prepare working plans, with a view of putting the work under contract.

BEAUMONT, TEX.—It is reported that water-works are to be erected here by the Reliance Water Company.

RIVERSIDE, CAL.—This place has voted \$150,000 bonds for the water company to make improvements and extend water privileges.

THE expenditure for sewers in Minneapolis last year was \$228,072, a little over six miles of sewers having been built.

OTTAWA, ONT.—Dr. Ferguson, M. P. for Welland, and Mr. Gross, of Welland, has asked the Minister of Railways for permission, on behalf of the town of Welland, to draw a supply of water from the Welland Canal for the new water-works there, now building. A satisfactory reply is anticipated.

KINGSTON, ONT.—The water-works system will undergo a great improvement. New mains are to be laid, two new Hyatt filters are to be placed in the lake, and an iron tank, 70 feet high, to add to the pressure of the water at the reservoir, will be erected. These improvements will involve the expenditure of \$100,000 over and above the \$120,000 which the city paid the con.pany for the works.

DOVER, N. H.—The question of constructing a water works system here having been decided favorably, the City Council has directed Percy M. Blake, C. E., of Hyde Park, Mass., to prepare working plans and specifications for the proposed system, and to present the same to that body, who will proceed with the work immediately.

Grand Rapids, Mich.—It is probable that the Board of Public Works will expend about \$12,000 in making repairs to different portions of the water-works system, laying new mains, etc. It is proposed to procure a new pump for \$5,000, a new boiler for \$4,000, and use the remainder of the appropriation asked for in substituting iron mains for some of the wooden ones. The Common Council will dispose of the matter at its next meeting.

ANDERSON, CAL. — Our correspondent writes: "The Anderson Water Co. is now constructing a ditch, which will be about eight miles long. It will conduct the water into a reservoir or large cistern, to be dug later. This reservoir will be at an elevation of at least 150 feet above the town. Mains will carry the water from this reservoir to all parts of the town, to be used for household, fire, and irrigating purposes."

SIDNEY, O.—Our correspondent writes: "The question of the appropriation of \$6c,000 for the improvement of our water-works will be voted on January 3, 1888."

FAIRHAVEN, MASS.—Our correspondent writes from here as follows: "The scheme for a water works in the town of Fairhaven is only a scheme as yet, but as it is a great necessity, both as a sanitary measure and for fire service, it is hoped some capital interested in building such work will visit the town and investigate it as an investment. There is a natural supply of water nearly in the centre of the town. The mains would be short, and furnish a thickly-settled district, and the town would pay well for hydrants."

BOOTHBAY, ME.—It is reported that H. A. Hancox, of Hudson, Mass., will construct a system of water-works here.

DELAWARE, O.—The Delaware Water Company has been incorporated. Capital stock, \$1,000,000. T. M. Marriatt, B. W. Brown and others are the incorporators.

CUCAMONGA, CAL.—The Cucamonga Water Company has been incorporated. Capital stock, \$100,000. E. T. Wright, W. B. Nicholson and others are the incorporators.

PERTH AMBOY.—It is probable that steps will scon be taken here to improve the water-works system. The present supply is unwholesome, and has been declared unfit for use. It is possible that a supply will be obtained from Rahway.

NILES, ().—Dr. Miner has purchased the Holly pumps, formerly in use in the Youngstown water-works. They will be placed in the Baldwin Mill in this place, and a system of water-work, may be inaugurated for the benefit of private consumers, or perhaps the town; but, our correspondent writes, "as yet no steps in that direction have been taken."

CAMBRIDGE, MASS.—In reference to the water-works improvements at this place our correspondent writes as follows: "Cambridge pumps from Fish Pond her water-supply into a reservoir for low service and into a standpipe for her high service; area about 160 acres. The increase in consumption and other causes covering several years drew the water down some 14 feet, which made it necessary to place a temporary pumping plant on the border of the pond to supply the conduit running to the large pumps. The extension was the laying of a 30 and 36 inch iron pipe about 9 miles long, the building of a dam some 30 feet high and 850 feet long in Waltham, all completed a month ago. We can deliver at the pond ten million gallons daily."

COLUMBUS, O.—It is probable that there will be considerable sewerage work here soon.

MARION, IA.—Our correspondent writes concerning the report of the incorporating of water-works here: "Our works have been running about one year, although we did not incorporate until a few months since. Our system is not entirely completed, having several miles of mains to lay next season. We contemplate purchasing an additional boiler of about 65 horse-power."

NEWPORT, N. H.—Efforts are being made to organize a company here to furnish water from Sunapee Lake.

MARION, VA.—Water-works are to be constructed here in the spring.

SCENEGA, CAL.—The Pirie Water Company has been incorporated with a capital stock of \$20,000. Robert Strathearn, J. M. Horton and others are the incorporators.

McMinnville, Tenn.—It is rumored that a 40-foot water-tank is to be erected here and that water-mains are to be put in the principal streets.

FRANKFORT, MICH.—A special election has been ordered by the Village Council, to be held some time in January, to decide whether or not water-works shall be established here.

KANSAS CITY, Mo.—The Buffalo Express of December 23, says: "The Holly Manufacturing Company, of Lockport, N. Y., has received the contract to furnish a 10,000,000-gallon engine for the water-works here."

MILWAUKEE, Wis.—The Fire Department will purchase a 75-foot copper water-tower.

BRIDGES.

SIOUX CITY, IOWA.—There is talk of erecting a \$35,000 bridge here.

NEWPORT, KY.—The Central Railway and Bridge Company, of this city, is about to file an application with the Secretary of War for permission to build a bridge between Cincinnati, O., and Newport, Ky.

FORT SMITH, ARK.—The question of erecting a bridge over the Potean River, at this place, is being agitated, and it is probable that conclusive steps will soon be taken.

MONTGOMERY, ALA.—The Board of Revenue has decided to erect two bridges near this city.

SAN FRANCISCO, CAL.—The Santa Inez Water Company has been incorporated with a capital stock of \$1,000,000. Edgar W Steele, San Luis Obispo, and others are the incorporators

CHICOPEE, MASS.—It is reported that a bridge is to be built here by the County Commissioners.

KANSAS CITY, Mo.—A bridge is to be built here by the Holmes Street Cable Car Company.

McConnelsburg, PA.—J. E. Downs can give information concerning a bridge to be erected here by the County Commissioners.

ST. AUGUSTINE, FLA.—Concerning a report that the County Commissioners were to build a bridge here, our correspondent writes: "We have no bridge to build for next twelve months."

LAUREL, DEL.—Address H. F. Kenny, 233 South Fourth Street, Philadelphia, Pa., General Superintendent Philadelphia, Wilmington and Baltimore Railroad, for particulars concerning a bridge to be erected here.

GREAT FALLS, MONT.—A bridge is to be built here. Address C. Shields, Minot, Dak.

DUNNVILLE, WIS.—A bridge is to be built here by the County Commissioners.

DAYTONA, FLA.—The County Commission-

GAS AND ELECTRIC-LIGHTING.

MANCHESTER, CONN.—The question of electric lights is being discussed by the city officials, and it is probable that something definite will soon be done.

DECATUR, ILL.—It is said that the electric light company at this place will soon want 100,000 pounds of wire.

THOMASTON, CONN.—An electric light company has been formed here for the purpose of proceeding at once towards lighting the city. The capital stock is \$20,000, and Aaron Thomas, B. W. Pease and others, are the incorporators.

LOCK HAVEN, PA.—An electric light company has been formed here, with Samuel Christ, T. C. Kintzing and others, as incorporators. The capital stock is \$20,000.

ARLINGTON, N. J.—An electric lighting plant is to be erected here by the Thomson-Houston Electric Light Co., of Boston, Mass.

ATHOL, MASS.—The citizens of this place are talking of establishing an electric-light plant.

LOCKPORT, N. Y.—Parties owning the gas-wells at Getsville, ten miles south-west of here, have signified their intention of acquiring the right of way to this city and constructing a natural-gas pipe-line here. They propose to light and heat the city. They have five wells already sunk at a depth of 500 feet each, and claim they will have an unlimited supply.

HOMER, N. Y.—It is rumored that the local water-works company will light the public streets by electricity.

ELMIRA, N. Y.—Natural-gas has been struck near here, and a company has been formed to further operations.

DETROIT, MICH.—The contract between this city and the Brush Electric-Light Company, to light the public streets for the next three fiscal years, has been executed.

CHARLESTON, W. VA.—It is reported that this place is to be lighted with e'ectricity by the Kanawha Electric-Light Company.

FREEBORN, MINN.—Natural gas has been discovered here, and it is probable that a company will be formed.

GREEN COVE SPRINGS, FLA.—An electriclight plant is to be erected here by the Green Cove Electric Company.

CHAMBERSBURG, N. J.—The question of electric-lights is being agitated here, and the Light Committee of the Common Council has been given power in the matter.

FORT GRATIOT, MICH.—This place will pipe for natural gas at once.

THE Gas and Electric Light Company, of York, Neb., has been incorporated. Capital stock, \$8,000. D. E. Sedgwick, M. Sovereign and others are incorporators.

RUTLAND, VT.—The Rutland Electric Light Co. has increased its capital stock by \$25,000 and will make extensive improvements to their plant.

PLAINVILLE, N. Y.—There is talk of having a natural-gas stock company here.

HOLLAND, MICH.—The place has decided in favor of electric lights.

PIQUA, O.—The Mercer Gas and Fuel Company has been incorporated; capital stock, \$700,000. George H. Smeiley, James B. Townsend, and others are corporators.

MAUCH CHUNK, PA.—A company with a capital stock of \$1,500 has been organized here for the purpose of lighting the streets with electricity.

LAMAR, COL.—This place is to be lighted by electricity. T. J. Matthews and others have formed a company with \$50,000 capital stock.



RAILROADS, CANALS, ETC.

BRIDGEPORT, CONN .- At the annual meeting of the stockholders of the Housatonic Railroad Company it was voted to build a branch line from Newton to Huntington, a distance of ten miles.

HELENA, ARK .- The Helena Street Railway Company has been organized, with W. W. Schoolfield, H. G. Miller and others, as directors. Work will be commenced as soon as the weather permits. Mr. John Gunn. of Memphis, will probably have charge of the construction of the road.

KANSAS CITY, Mo.—It is reported that H. P. Selden, 535½ Walnut Street, has been awarded the contract to construct a line of railway for the Kansas City, Rich Hill and Standard Reilman Contract of the Contra Southern Railway Co.

BIDS OPENED.

MONTREAL, CAN. — Tenders for special castings (132 tons) were opened by the Water Committee of the City Council on December 14. and were as follows:

E. Chanteloup, Montreal, \$60 per ton. Bellhouse, Dillon & Co., Montreal, \$50.50

per ton.
Alex. Garthshore, Hamilton, Ont., \$61.20

per ton.

B. I. Coghlin, Montreal, \$55 per ton.
T. T. Turnbull & Co., Montreal, \$55 per

ton.
Chagnon & Co., Longueiul, \$39.70 per

ton.

H. R. Ives & Co., Montreal, \$48 per ton.
John McDougall, Montreal, \$46.20 per

Cooper, Fairman & Co., Montreal, \$62.74

P. Arnesse, Montreal, \$46.20 per ton. Contract not awarded.

HOLMESBURG, PA.—Synopsis of bids for work and supplies for the Holmesburg, Pa., Water-Works, now being constructed, opened December 20. by Isaac S. Cassin, C. E., Philadelphia, Pa.:

James G. Meehan, Holmesburg, Pa., subsiding reservoir, complete, \$4,285.

Henry Opperman, Jr., Harrisburg, Pa., \$1,666.

Robert Pyle, Wilmington, Del., \$4,695. J. Irwin Hillpot, Philadelphia, Pa., \$4, 875.22.

Henry J. Taylor, Philadelphia, Pa., \$6,-120.

R. D. Wood & Co., Philadelphia, Pa,

fire-hydrants and valves, \$1 480.
Union Hydraulic Works, Philadelphia, Pa., \$1,488.60.

James Henshall & Son, Philadelphia, Pa.,

\$1.574.10.
Thompson & Campbell, Philadelphia, Pa.,

\$1,641.45.
Contract for subsiding reservoir awarded to James (i. Meehan, Holmesburg, Pa., and for fire hydrants and valves to Union Hydraulic Works, Philadelphia, Pa.

BIRMINGHAM, ALA.—The contract for the plumbing and gas-fitting in the Charleston block, at Bessemer, has been awarded to W. H. Franklin, of this city, for \$3,600. The block is to cost \$150,000.

ELIZABETH, N. J.-The New York and New Jersey Globe Gas-Light Company has been awarded the contract to light the streets of this city for a term of one year, to begin January 1, at a cost of \$17 per light. There will be 500 lights.

ALLEGHENY, PA.—The contract for the water-tank has been let to Saylor, Briggs & Lyons for \$2,283.

PRINCETON, ILL.—The City Council has awarded the contract for the artesian well to J. P. Miller, of Chicago.

CHICAGO, ILL. - The contract for rebuilding the docks and pile foundation for the ware-houses of the Anchor Line and Western Re-frigerating Company has been awarded to W. T. Casgrain, of Milwaukee, Wis.

NORTH ATHENS, TENN .- The Union Iron Works, of Chattanooga, have the contract for building water-works at this place. The cost will be \$15,000.

NEW YORK CITY.-The Aqueduct Commissioners have awarded the contract for the construction of the Sodom dam to Sullivan, Ryder & Dougherty, whose bid was \$366,990.

NEW YORK CITY. - Synopsis of bids for preparing for and building a new wooden pier at the loot of East 117th Street; for preparing for and building a new crib bulkhead, with appurtenances, at the foot of East 117th Street, and for dredging thereat, opened December 19 by the Department of Docks: The engineer's estimate of the nature, quantities and extent of work includes 2,800 cubic yards of dredging, 6.150 cubic feet of cribwork, complete, besides 22,886 feet, B. M., work, complete, besides 22,886 feet, B. M., yellow pine timber, and other material. The following were the bidders: John Gillies, \$13,627.50: O'Connell & Coffey, \$15.017.50; Richard Cronin, \$12,400,50; John W. Flaherty, \$11,147.50: William P. Kelly, \$11.640; John M. Monks, \$17,576.50. The contract was awarded to John W. Flaherty.

DENVER, COL.—Synopsis of bids for furnishing material and constructing a bridge over the Platte River, opened by Charles H. Scott, County Clerk, December 12

W. E. Edom, Denver, Col., whole work, \$1.108.

R. Jackson, Denver, Col., whole work, \$1,170.

The contract has been awarded to the lowest bidder.

MONTREAL, CAN .- The following bids for cast-iron water-pipes were opened by the Water Committee of the City Council December 14, 1887:

Alex. Thos. Paterson, Londonderry, N. S. 6, 10, 12, 20, 30 inch pipes, 1,800 tons, at \$32.10 per ton.

R. D. Wood & Co., Philadelphia, Pa., \$37,-

35 per ton.
Macfarlane, Strang & Co., Glasgow. Scotland, Coglin. agent, Montreal, \$36.06 per ton.
Macfarlane Strang & Co., Glasgow, Scotland, Turnbull & Co., agent, Montreal, \$35.91

Bellhouse, Dillon & Co., Montreal, \$34 per

A. Holden, Montreal, \$35 per ton.
A. Holden, Montreal, \$41 per ton.
R. McLaren & Co., Glasgow, Scotland, \$34.57 per ton.

George Reaves, Montreal, \$36.65 per ton. Alexander Gartshore, Hamilton, Ont.,

\$32.48 per ton.
Middleton & Meredith, Montreal, \$34.99

Per ton.

R. N. C. Connal, Montreal, \$35 per ton R. N. C. Connal, Montreal, \$35 per ton. George Dibley & Son, London and Montreal, 30, 20, and 12 inch, \$35.80; 10 inch, \$36.30; 6 inch, \$37.15 per ton.

I. H. Taylor, for D. Y. Steward & Co., Glasgow, 30, 20, and 12 inch, \$35.90; 10 inch, \$35.20; 6 inch, \$35.50 per ton.

Clay, Cross & Co., Chesterfield, England, 30 inch, \$35.87; 20 inch, \$35.87: 12 inch, \$36.11; 10 inch, \$36.72; 6 inch, \$37.87

\$36.11; 10 inch, \$36.72; 6 inch, \$37.08 per

Cooper, Fairman & Co., Montreal, 30, 20, and 12 inch, \$30.89; 10 inch, \$37.52; 6 inch,

\$38.16 per ton.

Cox & Green, Montreal, 30, 20, and 12 inch,
\$35.16; 10 inch, \$36.10; 6 inch, \$36.96 per

ton.
Contract awarded to Alexander Thomas
Paterson, Londonderry, N. S., Canada.

NEW YORK CITY.—Synopsis of bids for the gate house at South Yonkers, N. Y, opened December 14 by the Aqueduct Commissioners:

John Pierce, New York City, granite dimension masonry, per cubic yard, \$45; broken ashlar, cubic yard, \$35; hammer face dressing, square foot, 80 cents; rough pointed face dressing, square foot, 50 cents; rough complete. square foot, 80 cents; rough pointed face dressing, square foot, 50 cents; roof, complete, \$1,700; double doors, complete, \$100; windows, complete, \$20; wrought iron, not in roof, \$80; cast iron, not in roof, \$98.

O'Brien & Clark, New York City, granite dimension masonry, cubic yard, \$45; broken ashlar, \$40; hammer face dressing, square foot, \$80 cents; rough pointed face dressing, square

80 cents; rough pointed face dressing, square foot, 40 cents; roof, complete, \$3,000; double doors, complete, \$200; windows, complete. \$50; wrought iron, not in roof, \$100; cast iron, not in roof, \$80.

DULUTH, MINN .--The contract for the new coal dock for the Pioneer Fuel Company, of Minneapolis, has been awarded to William B. Sharp, of this city, at a cost of \$75.000 The dock is to be 1,000 feet long, by 350 feet in width, and will have a hold capacity of 500,000 tons. It will also be of solid crib

MILWAUKEE, WIS .- The advertisement for bids for improving Ashland Harbor has been withdrawn and bids will not be received as at first contemplated.

MECHANICVILLE, N. Y .- The contract to build the new bridge across the Hudson at this place has been let to the Hilton Bridge Company, of Albany, by the officers of the Mechanicville Bridge Company. The bridge is to be built for a sum between \$21,000 and \$22,000.

GOVERNMENT WORK.

HIGHWOOD, ILL.—Synopsis of bids for the construction of huts for the U.S. troops, opened recently by J. D. Bingham, Assistant Quartermaster-General, U.S. A., Chief Quar-

termaster:
Henry Munson, \$8,575 69. John Ramcke, \$8,748. Thomas Morset & Son, \$6,833. I homas Morset & Son, \$0,533.

S. A. Hardy, \$7,239.10.

Dupre & Schoolev, \$11,200.

Isaac L. Phillips, \$5,544.

D. H. Hayes, \$6,996.

John Taggart, \$8,100.36.

Adam J. Weckler, \$7,157.20.

The contract was awarded to Isaac L. Phillips, December 8

lips, December 8.

Washington, D. C.—The opening of bids for plumbing, etc., in the Sub-Treasury Building has been postponed until January 3.

PORTLAND, ORE.—Synopsis of bids for one fire-proof safe, with burglar-proof chest, for Register's Division at the Custom-Fouse, opened December 17 by the Supervising Architect of the Treasury Department: Macneale & Urban, \$735: Mosler, Brown & Co., \$595: Hall Safe and Lock Co., \$626; Mighill & Richards, \$620.

WHEELING, W. VA.—Synopsis of bids for banker's chest, opened December 17 by the Supervising Architect of the Treasury Department: York Safe and Lock Co., \$215; L. H. Miller, \$149; Macneale & Urban, \$242; Mosler, Brown & Co., \$198; Farrel & Co., \$350; Hall Safe and Lock Co., \$425.

WASHINGTON, D. C.—Synopsis of bids for furnishing and laving encaustic tiling, opened December 21 by Thomas Lincoln Casey, Colonel, Corps of Engineers: Sharpless & Watts, Philadelphia, Pa., \$1,450; Hayward & Hutchinson. Washington. D. C., \$1,467; Star Encaustic Tile Co., Pittsburg, Pa., \$1,844; J. F. Manning & Co., Washington, D. C., \$2,007 **\$2,0**97.

-Synopsis of bids for stone and brick work for basement and area walls of the Court-House, opened December 20 by the Supervising Architect of the Treas-

ury Department:
D. C. Anderson, San Antonio, \$9,272; for additional stone, 25 to 30 cents per cubic foot

per sample.
Pauly & Dielmann, \$12,880; for additional stone, \$3.25 for granite, 75c. for limestone, per cubic foot.

Dumesniel & Bros., for Boerne and red Texas stone, \$13,700; \$4.60 for granite and \$1.50 for brownstone; Bedford stone, \$16,000; Boerne and Richmond stone. \$14,200; \$5.30

for granite and \$1.50 for brownstone.

Jobst Bros., \$14.224.91, Dix. and N. and Mo. granite; \$4.25 for granite; Bedford and o. granite, \$16,424.91. Hicklejohn & Kleindienst, \$14,485; \$1.25

for granite and 25c. for limestone.
Walsh & Lewis, No. 1 brick, \$15,900; 90

and 75 cents; No. 2, \$16,900.
George W. Corbett, \$17,300; \$2.50.
Kelly Bros., \$18,000; 9c.
McCarthy & Baldwin, \$18,786; \$7 for granite and \$2 for limestone.

MISCELLANEOUS.

PROFESROR KESSIER, of Milwaukee, has PROFESROR KESSIER, of Milwaukee, has discovered molybdenite in the vicinity of Chippewa Falls. Wis. This mineral is very rare and valuable, being worth \$6 per pound. Molybdenite is found in only one other place in the United States, near Reading, Pa. The only other countries in which it is found are Norway and Sweden.

ELEVATORS AND MOTORS .- M. P. Levy, Mobile, Ala., wants the address of manufac-turers of hydraulic elevators and motors to run elevators.

MILWAUKEE, WIS .- The Fire Department will negotiate for a fire-engine steam-boat. Chief Foley of the Fire Department can be addressed.

CHICAGO, ILL.—The Lincoln Park Board has passed a resolution directing the Surerin tendent to confer with competent engineers and prepare two or more plans for the comple-tion of the breakwater or sea wall north of North Avenue.

THE St. Louis Auxiliary Fire Alarm Company, of East St. Louis, has been incorporated; capital, \$250,000. Its object is to provide means of furnishing an instantaneous alarm of fire by electro-magnetic connection with the fire-alarm system of cities. Incorporators: Henry L. Jackson, James C. Broadwell and others.

NEW CORPORATIONS.

The Vineland Water and Development Co., of Los Angeles, Cal.; capital stock, \$100,000; L. H. Washburn and others, di-

THE San Diego and Elsinore Railroad Company has been incorporated at San Diego, Cal. The capital stock is \$2,000,000. The incorporators are C. C. Stevenson Samuel Merrill, and others.

THE Citizens' Gas and Pipe Line Company, of Peru, Ind., has been incorporated; capital stock, \$100,000; J. D. Cole, Milton Shirk, and others, are incorporators.

THE Milwaukee and Geneva Railway Co. Capital stock, \$1,500,000. The incorporators are E. H. Waldron, C. A. Haslett, and

PITTSBURG, PA.—It is reported that the PITTSBURG, FA.—It is reported that the Pennsylvania Railroad Company contemplates the erection of a depot at Grant and Seventh Streets. Charles E. Pugh, 233 South Fourth Street, Philadelphia, General Manager, can

HANOVER, PA.—The Western Maryland Railway Company will probably build a depot in this city. For details address H. D Scott Superintendent.

THE Chicago, Hannibal and Springfield Railway Co.; capital stock, \$6,000,000. The incorporators are Rowland C. Nickerson, R. D. Fowler, and others.

THE North-western Car-Heating Co., of St. Paul, Minn., has been incorporated; capital stock, \$1,000,000; T. B. Mills, W. M Klinefeller, and others, incorporators

THE Minnesota Gas-Light Economizer Co., of St. Paul. The capital stock is \$200,000, and the incorporators H. C. Hemenway, John A. Higgins, and others.

THE Kaministiquia Iron Mining Co., with headquarters at St. Paul and a branch at Port Arthur, Ont. O. N. Murdock, V. Bowerman. and others.

THE Napa Electric-Light Co., of Napa City, Cal., has been incorporated; capital stock, \$50,000; Joseph O. Hirschfelder, George L. Henzel, and others, incorporators.

THE Seward Electric Light and Power Co.. of Seward, Neb.; capital stock, \$10,000; John Cattle, C. W. Barkley, and others incorpo-

THE Amsterdam, N. Y., Arc-Light Co. has been incorporated; capital stock, \$15,000; J. Enders Voorhees, James Voorhees, and others, incorporators.

PROPOSALS.

(Continued from page v.)

Pumping-Engine for Henderson, E.J.,

Water-Works.

PROPOSALS for one million (1,000,000) gallon duplex, double-plunger pumps, outside plunger and packing preferred, will be received on February 1, 1888, at the Henderson, Ky., Water-Works Office. For information apply to Fred. Kleiderer, Secretary, or James P. Wigal, Engineer and Subt.,

Committee.

SCHOOL.—Proposals are wanted at New Haven, Conn., until January 6, for the erection of a school building. Address L. W. Robinson, architect, 847 Chapel Street.

(Continued on page 64.)

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PROPOSALS.

STEAM BOILERS.—Proposals are wanted at New York City, until January 4, for two steam boilers, at Central Islip, Long Island, N. Y. Address Depart-ment Charities and Correction.

BRIDGES.—Proposals are was ted at Raleigh. N. C., until February 6, for constructing two bridges across Neuse River, in Wake County. Address Josse Winburn, of the County Commissioners' Bridge Committee.

BUILDINGS.—Proposals are wanted at New York City, until January 4, for three pavisions, a dining-room and kitchen, an administration building, a store-house, and a stable and wagon-house, at Central Islip, Long Island, N. Y. Address Department of Charities and Correction.

PAVING, CURBING. ETC.—Proposals are wanted at Brooklyn. N. Y., until January 3, for paving, curbing, etc., certain streets. Addr ss George Ricard Connor, Commissioner of the Department of Public Works.

IRON PIPE.—Proposals will be received at New Orleans, I.a., until December 3c, for furnishing 12-inch iron pipe for use of the lichthouse establishment. Address W. I. Fisk, Captain of Engineers, U. S. A., Light-House Engineer.

POST-OFFICE BOXES.—Proposals are wanted at Washington, D. C., until January 14, for furnishing and deliv ring post-office ock-boxes, and drawers with three keys each, for the Government building at Concord, N. H. Address Will A. Fieret, Superv.sing

DREDGING.—Proposals are wanted at New York City for dredging and removing from Mott Haven Canal 15,443 cubic yards of mud, etc., according to specifications. Until December 31. Address James C. Bayles, President Health Department.

DUPLEX STEAM PUMP.—Proposals are wanted at New York City, until January 4, for one duplex steam-pu up at Central Islip, Long Island N. Y. Ad-dress Department of Charities and Correction.

STEAM-HEATING.—Proposals are wanted at New York City, until lanuary 4, for steam-heating, for one pavilion on Randall's Island, Address Depart-ment of Charities and Correction.

WATER-TOWER, ETC. -Proposals are wanted at New York City, until Janurry 4, for a water-tower and tank, residence, engine, and boiler-house at Central Islip, Long Island, N. Y. Address Department of Charities and Correction.

COURT-HOUSE.—Proposals are wanted at Pine-ville, Ky., until January 28, for the erection of a court-house, jail, and jailer's residence. Address J. J. Gordon, County Commissioner.

SCHOOL.—Proposals are wanted at Birmingham, Ala., until January 2, for the erection of a school building. Address S. J. Hall, architect, 307% Twentieth Street.

COAL.—Proposals are wanted at New York City, until December 28, for turnishing the Department of Charities and Correction during 1888, according to specifications, 37.000 tons of white ash coal Address the Department of Charities and Correction, No. 66 Third Avenue.

BRICK CHURCH.—Proposals are wanted at Wy-andotte, Mich., until January 10, for building a brick church for the Evangelical I utheran Trinity Congre-gation. Address G. C. Bernethal, Secretary of Build-

FACTORY.—Proposals are wanted at Topeka, Kan., until January 1, for the erection of a factory. Address G. W. Watson, Topeka Sugar Co.

ACADEMY —Proposa's are wanted at Macon, Ga., until January 12, for the erect on of an academy building. Address J. J. Gresham, Chairman of the Board of Trustees.

FIRE ESCAPES, ETC.—Proposals are wanted at Washington, D. C., until January 2, for erecting fire escapes, stand pipes, platforms, and ladders on the public school houses in the city of Washington, D. C. Address William Ludlow, Engineer Commissioner.

SCHOOL ADDITION.—Proposals are wanted at Milwaukee, Wis, until January 6, for building an addition to 8th Ward school-house. Address H. P.

1RON FITTINGS.—Proposals are wanted at Mil waukee, W.s., until Japuary 2, for iron fittings for County jail. Address Frederick Wilkins, County Clerk.

WATER-WORKS.—Proposals are wanted at Dallas, Tex., until January II. for constructing, etc., two storage and subsiding reservoirs, according to specifications. Address W. E. Parry, City Secretary.

WATER WORKS,—Proposals are wanted at Hillsborn, Ill., until January 12, for constructing waterworks. Address the City Clerk.

LABORATORIES.—Proposals are wanted at Worcester, Mass., until D cember 31, for building laboratories for the Worcester Polytechnic Institute. Address Stephen C. Earle, Architect, 492 Main Street.

SEWERS.—Proposals are wanted at Williamsport, Pa., until January 18, for the construction, etc. of sewers in ceitain streets. Address R. H. Faries, City Engineer.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apar' inel-house; tes, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

110 Chrystie, brick ten; cost, \$20,000; o, Josephine Taylor; a, Julius Kastner.

27 W 57th. I brick and stone dwell; cost, about \$60,000; o, George E Dodge; a, G E

Av A, s w cor 71st, 1 brick factory; cost, \$14,000; o, Wm Marshall; a, E Wenz

Av A. w s, 20 s 71st, 1 br ten and stores; cost, \$14,000; o and a, same as last.

81st, n s, 100 w 8th av, I stone dwell; cost, \$25,000; o, Christian Blinn; a, A B Jennings. 127th, n s, 100 e 7th av, t br factory; cost, \$10,000; o, G D Eighmie; a, C T Mott.

Madison av. n w cor 135th, 2 br and terracotta dwells and 7 3-story and cellar br and terra-cotta dwells and stores on 1351h st; cost, total, \$60,000; o, Henry A Cram; a, William

163d, n w and n e cor Cauldwell av, 7 fr dwells, 3 houses on n w cor and 4 on n e cor; cost, each, \$4,000; o, a, and b, J W Decker.

Ss Clifton st, 100 ft w of Forrest av, 2 fr dws, cost all, \$7,000; o, Robt Gocey; a, C Pfeiffer.

Es 9th av, 75 ft n 100th st, br flats and stores; cost. \$16.000; o, Thos R W Hall; a, G A Schellinger.

148 E 84th st, br flats; cost, \$16,000; o, J C Blanke: a, Kerster & Wallis.

N w cor 92d st and Boulevard, 3 br flats and stores: cost, \$25,000; o, Fred Bollwage and others; a, Jas S Post.

W s Boulevard, 24 ft w of 92d st, 3 br flats; cost all, \$00,000; o and a, same as above.

W s Boulevard, 107 ft w of 92d st, br flats; cost \$15,000; o and a, same as above.

ALTERATIONS-NEW YORK.

21 Suffolk; cost, \$8,000; o, Meyer Cohen; a, Rentz & Lange.

BROOKLYN.

66-70 Linden, 3 fr dws; cost, \$11,400 all; o, Anna A Faldon; a, not given.

S s Degraw st, 98 w 5th av, 3 br dws; cost, \$13.500 all; o, Assip & Buckley; a, W M

S s Grove st, 400 w Central av, 2 fr dws; cost, \$10,000 all; o, Jas A Bills; a, Mathew Thornton.

N s President, 184 w Clinton, br apartment ouse; cost, \$20,000; o, Assip & Buckley; a, house; cost, a

S s 26th st, 175 w 5th av, 2 fr tens; cost, \$8,000 all; o, Patrick Donlin; a, James Pat-

N s Baltic st, 160 w Third av. 2 fr tens; cost, \$8,000 all; o, Phil McDermott; a, not given.

S s Palmetto st, 375 s Central av, 2 fr dwf; cost, \$9,600 all; o, J Stalf; a, Henry Schoef-

MISCELLANEOUS.

MILWAUKEE, WIS.—The plans of H P Schnetzky have been adopted for the addi-tions to the 8th Ward school; the improvements will cost \$8,000.

425 E Water, alteration; cost \$10,000; o, H Brodhead; a, E T Mix & Co; b, A Kloes.

DELAVAN, WIS.—A \$50,000 hotel is to be erected here by Chicago parties.

CHATTANOOGA, TENN.—Georgia av and Market pl, block of 2 story brick bldgs for stores; cost, \$37.000; o, Cincinnati Invest-ment Co; a, W H Floyd; b, D J Chand-

BALTIMORE. MD .- Laurence and Park avs, 2 br bldgs; o, W L Stork.

Cor Howard and Clay, br and st ware-house; o, Hutzler Bros; a, E F Baldwin.

DETROIT.-Palmer, br dw; cost, \$9,000; o, J M Nicol; a, Scott & Co; b, McGrath & Wallich.

Grand River, bk factory; cost, \$10,000; o, J E Scripps; a, Scott & Co; b, D Lane.

PHILADELPHIA.— Amber, ab Huntingdon, 21 dwells; o, C C Moore.

Huntingdon, bet Amber and Collins, 7 dwells; o, C C Moore.

Barnwell, s of South, 20 dwells; b, Jas C Lynch.

Market, w of 18th, brick store; b. A M Smedley.

Penepack, passenger station Pensylvania Railroad Co.

Merion, bet 48th and 49th, 12 dwells; b, Biern & Keller.

BOSTON.— 47 Hartford, wooden dwell; cost, \$7,500; o, a, and b, Chas F Gifford. Homestead, near Walnut av, wooden

dwell; cost, \$8,000; o, E H Gilmore; a, O W Wentworth; b, owner. Humboldt av. wooden dwell: cost. \$10,-

ooo; o, F E Wilbur; a, A H Vinal; b, W J Jobbling. Warren, near Townsend, wooden dwell; cost, \$12,000; o. F Ferdinand; a, G A Avery; b, W A & H Root.

Gleason, near Howard, wooden chapel, cost, \$10,000. o, Harvard St Congregational Society; a, H Mosely; b, Meade, Mason & C.

274-284 Shawmut av. 3 br stores: cost, \$15,000 each; o, Allen, Gibson & Thomp-son; a, Fred Pope; b, Stevens & Gilmore.

47-51 Pembroke, 3 brick aparts; cost, \$9.000; o. Godfrey Mouse; a, Weistone & Jones; b, J W Thompson.

257-259 Commonwealth av, brick dwell; cost, \$100,000; o, A Cochrane; a, McKim, Mead & White; b, Thomas Lyons.

19 Gloucester, br dwell; cost, \$120,000; o, F. R. V. Thayer: a, Sturges & Brigham; b, David Connery & Co.

Harrison av, cor Fxter pl, brick stores; cost, \$35,000; o, H H Hunnewell; b, Shaw & Hunnewell; b, L D Wilcutt.

39-45 Essex, br stores; cost, \$18,000; o, C Shaw; a, S D Kelley; b, Webster, Dixon & Co.

15-19 Emerald, br church: cest, \$13,000; o, Advent Christian Society; b; John Marchbank.

12-16 Temple pl, br stores; cost, \$35,-oco; o, R H Stearns; a, Carl Fehmer; b, Emery & Stuart.

Floral pl, br stores; cost, \$45,000; o, fass Gen Hospital; a, Carl Fehmer; b, Mass Gen H James Smith.

25-27 Common st. br storehouse: cost. \$110.000; o. R B Brigham; a, John R Hall; b, M Grant.

1-7 Tremont st, brick store and offices; cost. \$120,000; o, Henry E Chadwick; a, S J F Thayer; b, Emery & Stuart.

CHICAGO, ILL. -238-44 Franklin, 7-story br and st warehouse; cost, \$65,000; o, C L Willoughby; a, Geo H Edbrooke; b, W A & A E Wells.

1852 35th, br store and flats; cost, \$8,000; o, Thos Sullivan; a, L H Hienz.

1273-75 W Van Buren, br store and flats; cost, \$14,000; o, A T Lay; a, W L Carroll; b, J E Davis.

27 buildings less than \$7,000 in value.

ST. LOUIS, MO -Pine st and Cabanne av, br dwell; cost, \$14,000; o, M Bauman; a, Grable & Weber; b, sub-let.

Bacon and N Market sts. 5 adj br dwells; cost, \$16,000; o, M Trendeville; a, J H Kearney.

KANSAS CITY, MO. - 53 minor bldgs aggregating in cost \$28,500

None costing \$7,000 or over. STILLWATER, MINN .-- John Glaspie will

erect a brick block.

MINNEAPOLIS, MINN.—C S Moore will erect a \$20,000 brick block on West Seventh

WATSESSING, N. J.—An Episcopal church will be erected here, at a cost of \$20,000.

SYRACUSE, N. Y .- The congregation of St James Episcopal Church, Syracuse, will erect a new building.

PORTLAND, ME .- The First Presbyterian Church congregation is to have a new build-

COLUMBUS, O.—A United Presbyterian church is to be erected in this city.

COLUMBIA, PA.—The Presbyterian congregation of Columbia contemplates erecting a new church.

DETROIT, MICH.—The people of Plymouth Congregational Church will build an edifice, to cost \$100.000. The architects edifice. to cost \$100.000. The a are Spier & Rohns, 54 Buhl Block.

MILFORD CENTRE, O .- The Chicago, Sr Louis and Pittsburg Railway Co will build a depot here. John F Miller, Colum-bus, the General Superintendent, can give details.

SAGINAW, MICH.—The Flint & Pere Marquette Railway Co has decided to build a depot here. Sanford Keeler, East Saginaw, is in charge.

OMAHA, NEB .- The Burlington and Missouri River Railroad Co in Nebraska, will build a depot in this city. T. E. Calvert, Lincoln, General Superintendent.

FORT WAYNE, IND.—The congregation of St. Paul's German Lutheran Church will build a \$75,000 edifice.

DENVER, COL.—The members of the Evans Methodist Church will build an edifice, to cost \$65,000.

MORRISTOWN, N. J.—The members of St Peter's Church. Morristown, will build an edifice. The estimated cost is \$110,000.

NEWPORT, R. I.—The Masonic Society will make improvements to their building to cost \$17,000.

BIRMINGHAM, ALA.—The Masonic lodges will build a large structure here.

PITTSBURG, PA.-The Fidelity Trust Co., 434 Wood Street, will erect a building to cost \$100,000.

CANTON, O -The Y. M. C. A. will erect a new headquarters in this city.

FINCASTLE, VA.—A large building is to be built here by the Y. M. C. A.

KANSAS CITY, MO .- A new building here by the Hyde Park Club.

WETUMPA, ALA.—The Masonic Society contemplates building a large edifice. EAST HAVEN, CONN .- The New York,

New Haven and Hartford Railroad Co. will build a depot here. O. M. Sheppard, New Haven, can give information.

DERBY, CONN.—The New Haven and Derby Railway Co. will build a depot at this place. E. S. Quintard, New Haven, is the superintendent.

CRYSTAL SPRINGS, N.Y.—A large hotel is to be erected here. Address J. J. Paddock.

SEA ISLE CITY, N. J.—P. A. Somerset will erect a \$60,000 hotel here. WEST NEWTON, PA .- Henry Croushore

will build an opera house here. NARRAGANSETT PIER, R. I.-Address H W Green for particulars concerning a \$25,000 hotel to be erected here.

BERKELEY, CAL.—A hotel to cost \$150,000 is to be erected here soon. For full details address Dr. George M Barnibas.

CARMEL, N. Y .-- An almshouse is to be built here by the County Commissioners.

ORANGE, N. J —A \$10,000 addition is to be built to the Orange Memorial Hospital.

BOZEMAN, MONT.-The Commissioners will erect a borough building, to cost \$25,-

SPRINGFIELD, O.—The Y M C A of this city has decided to erect a new building.

ZANESVILLE, O.—A \$60,000 structure is to be built here; Oscar Cobb, of Chicago, Ill., is the architect.

UTICA, N. Y.—Secretary Shurtleff, of the Y M C A, can give information of a \$50.000 structure to be built by this organiza-

ABITA SPRINGS, LA. -Poitevant & Favre, of New Orleans, La., are interested in a hotel to be erected here (P O at Covington); the estimated cost is \$50,000.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE TENEMENT-HOUSE PROBLEM IN NEW YORK.

UNDER the above title the President of the Health Department of the city of New York, Mr. James C. Bayles, has presented to the Mayor of the city a report intended for the information of the commission on legislation affecting tenement and lodging houses as provided under existing laws. This report, forming a pamphlet of forty-five pages, gives a historical sketch of the various efforts which have been made to improve our tenement-house system, beginning with the report of the special committee appointed in 1856 by the State Legislature "to examine and report upon the condition of tenant-houses in the city of New York." It appears that there are now 30,055 tenement-houses in the city, and that there are forty-four members of the sanitary police charged specifically with the duty of constantly supervising the tenement and lodging houses and the enforcement of the Tenement-House Act, no one member having more than 1,100 tenement-houses under his super-

Mr. Bayles thinks that recent legislation has, to a great extent, given all the powers which the Health Department requires, and says: "Any important addition to our powers from this point of view would be an embarrassment;" or, as it is stated further on, "The Health Commissioners see no reason to ask the help of the Tenement-House Commission in securing increased powers through legislation." It is, however, suggested that the Board of Health should be given the right to file a lis pendens when proceedings are begun against an owner for violation of the rules governing the construction of buildings, and in support of this it is urged that purchasers of real estate should be able to find in the record office, notice of everything which affects the title to such property. "Builders and speculators take a most unfair advantage of the inability of the Health Department to file notices of violation where they will become part of the record and be found in a search of title, and many purchasers are every year surprised to find themselves under the necessity of making expensive alterations to avert heavy penalties for opening their buildings to the occupancy of tenants.'

It is also hinted that the Department of Public Works might co-operate with the Health Department more than it does, by granting permits to connect with the Croton supply only on a certificate from the Health Department that the plumbing regulations have been complied with.

This latter suggestion, we are glad to notice, has since been adopted by the Commissioner of Public Works, and we trust the former will also be favorably acted upon. Certainly, it is a very moderate request, and it seems reasonable and proper that it should be complied with. The whole report is a simple and sensible document, and, while it may possibly take a view of the situation which is rather rose-colored, we believe its recommendations to be wise, and that they should have all the more weight because of the absence of sensational appeal from and the studied moderation in the statements upon which they are based.

A NEW WAY OF SOLVING ENGINEER-ING PROBLEMS.

WHEN a city begins to feel the need of a system of sewerage and of the regulation and supervision of house drainage, there are always several different plans proposed. The best way to secure a proper selection of plan is, as we have often had occasion to state, "to select a competent engineer of good repute and to abide by his recommendations." Dr. Falligant, of Savannah, proposes a new plan. The usual form of controversy as to whether something shall be done to improve the sewerage of Savannah, and, if so, what? has been going on for some time, and, among others, Colonel Waring has recommended his system. Dr. Falligant, of that city, wants a somewhat different system, more especially as to modes of flushing, and offers, through the press, to bet \$1,000 that his own system will work well, the challenge being especially directed to Colonel Waring.

It will be perceived at once that this is a very different matter from offering to bet Colonel Waring that his (Waring's) plan would not work well, or from offering to bet that one plan would work better than the other. In fact, the more we consider the terms of the doctor's wager the more we are led to admire his shrewdness in securing free advertising without risk. But, despite this admiration, and the recognition of the fact that it is easier to bet than to argue, we are still of the opinion that Savannah would do well to abide by the decision of a competent and impartial engineer in a matter of such importance to her health and commercial prosperity as that of a system of sewerage.

GUARD-RAILS ON RAILWAY BRIDGES.

WE give on another page the recommendations of the Railway Commissioners of Massachusetts on the subject of guard-rails for railway bridges, in regard to which they say: "The Board are so impressed with the importance of this subject that they have given careful consideration to the merits and defects of the different forms, and they urgently recommend the general use of the form herein described.'

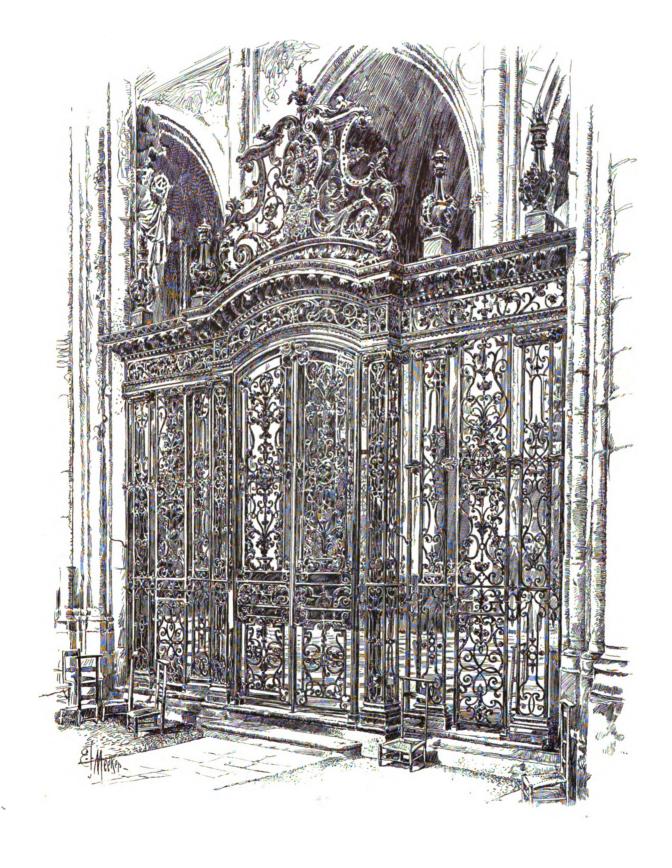
We believe we cannot do our railroad readers a greater service just now than to give them the benefit of this valuable advice on this most important detail of railway construction.

When it is considered that serious derailment on a deck-bridge means a plunge into the river below, and that the same thing on a through bridge adds the wreck of the bridge to that of the train, it will be seen that the importance of guard-rails on railway bridges can hardly be overestimated, and those roads which are properly provided in this respect deserve and should secure the preference of prudent travelers.

SPARE THE CITY HALL PARK.

EVERY citizen who desires to see the remnant of the New York City Hall Park spared to the public and the architectural ruin of the City Hall averted will be gratified to find the New York Tribune joining in the protest against the pro-prosed unwise action of the Sinking Fund Commissioners. In its issue of December 25 it gives generous credit to The Engineering and Building Record and also the Record and Guide of this city, for the stand we have taken in the matter. It quotes from the several articles that have appeared in this journal, the first of





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

GRILLES DE L'EGLISE, ST. OUEN, FRANCE.



which was in our issue of August 6. It also quotes from the Syracuse *Standard* and the letter of Mr. Hugh N. Camp, and then makes the following editorial recommendation, which we sincerely hope may be acted upon. The co-operation of the press of this city to prevent so serious a blunder is urgently needed:

"Advocates of the scheme for ruining the City Hall and despoiling the City Hall Park by the erection of a building in the form of two huge 'wings' have been keeping quiet for the last few days; but if they hope that the opposition will die out they are doomed to bitter disappointment Apart from the fact that the law authorizes a building, while two disconnected wings (so called) are planned, it is as clear as sunlight that not a single inch of this park should be surrendered for building purposes. Besides, as the extracts which we print elsewhere show, the proposed building will be an architectural monstrosity. The opinions of journals like THE ENGINEERING AND BUILDING RECORD and the Record and Guide are not to be lightly dismissed. Our City Hall is too noble a specimen of architecture to be experimented with or mangled. The way to settle this business with neatness and dispatch is for the Legislature promptly to undo what it did last year. Pass a bill rescinding the authority given to the Sinking Fund Commission to put up a building for city purposes, or at least amend the former act in such a way as to prevent the threatened outrage. This is a duty which the Legislature cannot afford to neglect."

THE "Novelty in Bridge Erection" illustrated in our issue of November 5 may suggest an arrangement of a draw-bridge that would be convenient in some localities.

A DETAIL in the installation of the new cable tramway at Birmingham, to which previous reference has been made, is interesting. To detect any broken wires the cable passes into the engine-house through an opening very slightly larger than its own dimensions, so that any loose wires will set an electric-bell ringing.

QUESTIONS ABOUT OHIO WATER-SUPPLIES.

DR. C. O. PROBST, of the State Board of Health, will soon send to nearly all places in the State a series of questions, propounded by Dr. H. J. Sharp, of the State Board of Health, in regard to the water-supply and disposal of sewage in the various towns of the State. The replies should contain much valuable information.

THE LONGEST BRIDGE IN ITALY.

THE iron railroad bridge over the Po, just opened at Casalmaggiore, Italy, is much longer than any previously existing in that peninsula. It comprises 17 spans, two of 55 m. at the ends, and 15 intermediate ones of 65 m. each, a total of nearly 3.560 feet. According to La Semaine des Constructeurs the foundations of the 16 piers and two abutments were constructed by the plenum process. One thousand tons of iron were used in building the 18 caissons, which were illuminated during the work by Edison electric lamps. The masonry in piers and abutments is computed at 14,600 cubic metres.

The bridge is single-track, continuous girder, and weighs 2,900 kilos per metre. It was built by the Savigliano shops, in charge of M. Cottrau.

FAILURE TO COLLECT DAMAGES FOR SEWER OVERFLOW INTO CELLAR.

A SUIT brought by a firm of butchers against the city of Milwaukee for damage caused by an overflow from a sewer into their cellar was decided in favor of the city. From the report of the trial it appears that this was a test case, which, if successful, was to be followed by a large number of others.

It appeared by the testimony that it was considered necessary in that section of the city to put back-flow traps on the house-drain to prevent water from the main sewer backing into the cellars, and instances were cited where it had been done in that neighborhood. On the judge's charge that the plaintiffs knew the condition of the sewer in that locality and the precautions of others in the matter of back-pressure traps, the jury found for the city, evidently regarding the plaintiffs as having neglected the precaution that they should have taken.

OUR ARCHITECTURAL ILLUSTRATIONS. GRILLES DE L'EGLISE, ST. OUEN, FRANCE.

OLD COLONIAL DETAIL SERIES.

HALL AT LOWER BRANDON ON THE JAMES RIVER,
VIRGINIA.

GUARD-RAILS ON RAILWAY BRIDGES.

THE following explanations and recommendations are taken from a recent circular addressed by the Massachusetts Board of Railroad Commissioners to the railroad companies in that State:

"The object of the guard-rail is to prevent a derailed truck from getting far enough off the track to strike any portion of the girder, or from becoming twisted so as to lead to further derailment. The floor of every bridge should, moreover, be so constructed as to be able to carry safely any derailed car or engine; and for this purpose, the ties should be substantial timbers, measuring not less than six by eight inches, and spaced not more than eight. and preferably four or six inches in the clear. Efficient guard timbers outside of the rails should also be provided, notched on each tie and bolted at short intervals—the object of such timber being to hold the ties in place, and to keep them from being bunched by a derailed wheel. Instead of notching the guard timber over the ties, it may be simply bolted, and spacing-blocks securely fastened between the ties to keep them apart.

"In addition to such guard-timbers, guard-rails are requisite, so arranged as to bring a derailed truck nearly back to its proper position, and guide it across the bridge without allowing it to deviate more than a few inches from the rails. For this purpose, outside guard-rails and inside guard-rails are in common use.

"The ordinary arrangement of outside guard-rails is as follows: The guard-timbers before described are placed six or eight inches from the rails, and are sometimes protected with an angle-iron fastened to the corner. At the ends of the bridge, or on each track at the end at which trains enter upon the bridge, curved rails extend from these guard-timbers, flaring outward and resting on long ties.

"The board recommend the use of the inside guard_ rail, placed with a clear space of from seven to ten inches between the heads of the guard-rail and the track-rail. securely spiked to the ties, and with ends running to a point in the centre of the track on the side from which trains approach. The distance of this point from the end of the bridge should vary in different cases, but should not be less than thirty feet, and preferably sixty feet on important bridges. If the approach is on a curve, the guardrail should be carried farther; and on sharp and short curves it is advisable to extend them entirely around the curve, or to run them to a point thirty or sixty feet from the bridge, and from this point to carry a single rail in the centre of the track around the curve. The point of the guard-rail should be protected by an old frog point or by a bevelled wooden block to prevent any hanging chain from catching on the end. The distance between the track and the guard rails should be sufficient to allow a wheel to run between them without crowding either rail, or from seven to ten inches.

"The board consider that this form of guard-rail is much more efficient than the outside guard-rail in bringing a derailed truck back to its proper position. On many roads the outside guard-rails extend but a short distance beyond the ends of the bridge, and are frequently curved abruptly so as to be nearly at right angles with the track. Furthermore, the long ties on which such guard-rails rest are generally insufficiently bedded in the ballast outside of the rails. The tendency of such a guard-rail is to stop the wheel which strikes it and to twist the truck still farther, placing it at a greater angle with the track, and thus tending to increase rather than to diminish the danger of an accident. The board consider such guard-rails to be worse than useless, and recommend that they be replaced by inside guard-rails without delay. Outside guard-rails of proper length, slightly curved and properly laid, may accomplish their intended purpose, but they are wrong in principle, because they are struck by the wheel at the wrong end of the axle, and if they do their work at all, they do it at great disadvantage.

"The objection is sometimes urged against inside guard-rails that a mischievous person may place an obstruction between the guard and track rails, or that some obstruction may accidentally get there. The board believes that this argument has no practical weight, and that even if a truck were derailed in this manner it would, by virtue of the guard-rail, pass safely across the bridge. A person who desires to wreck a train can find abundant means of doing it more effectual than this. Further objections are sometimes pleaded that the use of the snow-plough is rendered difficult, or that a hanging chain may catch on the point

of the guard-rail. These also appear to the board to have little weight. The points may be protected as already explained, and the use of the snow-plough is no more interfered with than at any turnout or crossing. Finally, it is sometimes urged that a truck, if derailed far enough to get on the wrong side of the point, would be still further deviated by the guard-rail.

"As long as a train holds together it is very rare for a truck to be off the track more than a few inches or a foot. If the train has parted and a truck is off by as much as one-half of the guage, the wheels on one side of this truck would be off the ties and a smash-up could hardly be averted, no matter what shape of guard-rail were applied. Certainly the ordinary form of outside guard-rail would do no good. Furthermore, the possibility of such an accident at a bridge may be almost completely removed by extending either the guard-rails or a single guard-rail on curved approaches, as has been suggested."

DESTROYING THE FIFTH AVENUE PAVE-MENT.

WE are glad to see the *Times* call attention to the fact that the Fifth Avenue pavement is taken up in spots, the foundation destroyed, and when the blocks are replaced they are simply put back in the sand. We noticed an instance of this kind in front of the residence of Mr. Cornelius Vanderbilt last week. On inquiry, the man in charge stated that the blocks were put back temporarily. We shall watch with interest to see when the concrete foundation is properly restored. Our opinion is that every opening of this kind would better be enclosed and travel over it prohibited until the department can restore the foundation and pavement properly. These temporary repairs simply result in making a series of depressions in the whole street, and breaking down the edges of the sound pavements.

If such makeshifts were not tolerated at all, but the disturbed places kept inclosed until perfectly restored, it would hasten such restoration and in the end save much inconvenience and expense.

THERE is likely to be some little discussion in the Private Bills Committee, when Parliament again meets, with regard to the new Tay Bridge. The Board of Trade officials, after inspection, have recommended that the piers of the former bridge should be left standing. The new Tay Bridge Viaduct Act provides that the railway company shall remove the ruins and debris of the old bridge and all obstructions interfering with navigation caused by the old bridge, to the satisfaction of the Board of Trade, although the Board of Trade officials now recommend the retention of the piers. The officials of the city of Perth are opposed to their retention, claiming that they cause an obstruction to navigation which would be detrimental to the interests of their city.

A PNEUMATIC DREDGE AND CONCRETER.

THE Revue Industrielle contains a description of a machine recently built in France upon the system of M. H. Jandin, to excavate for laying sea wall and jetty foundations at the Phillippine Isles. The place excavated will be surrounded by sheet piling, and the material removed will be discharged directly at a distance of 100 m. by compressed air from a pneumatic chamber through a conduit with flexible metallic elbows. The same apparatus will serve to fill the excavated space with beton carried under water by pipes that preserve it from dilution, distribute it regularly, and even ram it by successive pneumatic or hydraulic impacts.

ROTARY SNOW-SHOVELS.

THE Pioneer Press states that the Northern Pacific will this year put into use along its line four new rotary steam snow-shovels. These rotary shovels have never been used in the Northwest, although they have been thoroughly tried elsewhere. The apparatus somewhat resembles a box car containing a stationary engine, which works the shovel. On the front of the car is the rotary shovel, which gathers up the snow, and it can be run as fast as three hundred revolutions per minute. The snow passes back and is expelled from a spout on top of the car, being thrown far to one side. The apparatus is pushed by a locomotive, and can go through a snow-drift six or seven feet deep at the rate of fifteen or twenty miles an hour.



PAVEMENTS AND STREET RAILROADS. No. XXIV.

(Continued from page 54.)

SPECIFICATIONS FOR PAVING MATERIALS. PARISH OF CHELSEA.

Specification for the supply and delivery of wood blocks for paving portions of the streets known as King's Road and Pont Street, in the Parish of Chelsea.

1. Blocks.—The wood blocks are to be the best approved Swedish yellow deal, cut from Gothenburgh thirds, and are to be 9 inches long, 3 inches wide, and 5 inches deep. Notwithstanding any custom of trade, or any meaning usually attached to the description of blocks as "9 inches long and 5 inches deep," the length of the blocks to be supplied shall be such that when any twelve blocks are placed end to end in a straight line, so as to have their lengths in the same direction, the total length of the twelve blocks shall not be less than 8 feet 0 inches, and lengths in the same direction, the total length of the twelve blocks shall not be less than 8 feet 9 inches, and when any eight blocks are placed in an upright position, with their sawn faces in contact, the height of the eight blocks shall not be less than 3 feet 3 inches. With the approval of the surveyor to the vestry, blocks of a less length than will comply with the above requirement may be supplied, but in such a case the contractor is to supply such a number of blocks to each thousand, at his own cost such a number of blocks to each thousand, at his own cost and without payment from the vestry, as will make a total length at least equal to the length of the blocks as specified; but the number of such blocks of a less length shall not be more than one-third of the total number supplied, nor shall any block be of a less length than eight inches. The blocks are to be sound, square, properly and uniformly cut, free from sap, shakes, warps, large or dead knots, and other defects. A sample of blocks can be seen

at the office of the surveyor to the vestry.

2. Surveyor may inspect works where blo ks are cut, etc.

The surveyor to the vestry, or other person authorized by him, may, at all times during working hours enter the saw-mills, wharf, or other place of the contractor where the blocks are being cut, to examine the same, and may reject any deals or timber from which the blocks are about to be cut which, in his opinion, are unfit for the purposes

of this contract.

3. Number of blocks and delivery.—The contractor is to supply 640,000 blocks, of which 340,000 are to be supplied to King's Road, from Limerston Street to Lot's plied to King's Road, from Limerston Street to Lot's Road, and 300,000 to Pont Street, but the vestry reserve the right to take a less number, or to require the supply of a greater number. The blocks are to be delivered on the streets named at any part thereof, or on any of the side streets within thirty yards of such streets, and are to be stocked in such manner and at such times and places as stacked in such manner and at such times and places as the surveyor to the vestry shall direct. The contractor will not be required to deliver a greater number of blocks

than 20,000 per day.

4. Vestry may obtain other blocks if contractor fails to deliver.—The contractor is to commence the delivery of the blocks within ten days after the receipt of an order in the blocks within ten days after the receipt of an order in writing from the surveyor to the vestry, and is to proceed with such delivery in such quantities, and at such times as the said surveyor shall direct. The said surveyor shall have power to suspend the delivery of the blocks, as he thinks fit, on giving twenty-four hours' notice to the contractor, without any charges which may arise in consequence, being chargeable to the vestry.

5. Blocks to be approved by surveyor.—The blocks supplied are to be subject to the approval of the surveyor to the vestry, and any blocks which are not approved by him are to be removed from the works within six hours. The blocks are not to be considered as approved until they are

are to be removed from the works within six nours. Ince
blocks are not to be considered as approved until they are
laid in the streets as part of the pavement and grouted in.
A sum of ten shillings per thousand will be deducted from
the payments to be made under this contract to the contractor by the vestry, for every thousand of the blocks so
delivered on the works and not approved. If the condelivered on the works and not approved. If the contractor fails to remove the Llocks not approved in the time

allowed, the vestry may do so at his expense.

6. Pena ties if works delayed for want of blocks.—If the works are delayed or hindered by reason of the non-delivent ery of a sufficient number of blocks, the contractor shall pay to the vestry the sum of £10 per day or part of a day they are so delayed, and the vestry or their surveyor may obtain blocks from any person they think fit, and may deduct the extra cost of such blocks (if any) from the payments to be made to the contractor under this contract, together with the sums to be paid by him to the vestry for the delay of the works, or may recover such extra cost and sums from him or his sureties as and for liquidated

damages, as they deem best.
7. Payment.—Payment will be made to the contractor in monthly installments for the blocks laid in the street as part of the pavement on the certificate of the surveyor to the vestry.

8. Surveyor's decision to be final.—The decision of the surveyor to the vestry as to the meaning of this specifica-tion, or as to the quality or number of blocks supplied is to be final and binding.

George R. STRACHAN,

February 21, 1996 February 21, 1886. Surveyor to the Vestry.

Specifications for the supply and derivery of Than es bal last, sand, and pea gravel for paving portions of the streets known as King's Road and Pont Street, in the parish of Chelsea.

Thames ballast.—The Thames ballast is to be taken from the River Thames, the stones are to be regular in size, and not to exceed three inches in any dimension, the sand clean and free from clay, mud or loam, and the proportion of sand to stones is to be to the satisfaction of the

2. Sand.—The sand is to be pit sand or Thames sand of the best quality, clean and sharp, free from loam or clay, and when screened through a sieve of 400 meshes to the square inch no residue must be left.

3. Pea gravel.—The pea gravel is to be of clean water-worn stones, not exceeding three-eighths of an inch in any dimension.

4. Quantity.—The contractor is to supply the quantities of materials set forth in the form of tender of this specification; but the vestry reserve the right to take a less quantity or to require the supply of a greater quantity of any or all of them. They are to be delivered on the streets named, at any part thereof, or on any of the side streets within thirty yards of such streets, at such times and places as the surveyor to the vestry shall direct. The contractor will not be required to deliver more than 100 cubic yards of Thames ballast, 20 yards of sand, or 10 yards of pea

gravel per day.

5. Delivery.—The contractor is to commence delivery 5. Delivery.—The contractor is to commence genery within seven days after the receipt of an order in writing from the surveyor to the vestry, and is to proceed with such delivery in such quantities, and at such times as the said surveyor shall direct. The first order will be given on the 10th March instant. The said surveyor shall have power to suspend the delivery as he thinks fit, on giving twenty-four hours' notice to the contractor, without any charges which may arise in consequence, being chargeable to the vestry.

6. Materials to be approved by surveyor .supplied are to be subject to the approval of the survevor to the vestry, and any which are not approved by him are to be removed from the works within six hours. If the contractor fails to remove the materials not approved in the time allowed, the vestry may do so at his expense.

7. Measurement and approval.—The contractor is to bring an invoice with each delivery, stating the quantity and nature of the materials supplied, which is to be left with the person appointed by the surveyor to the vestry to receive such materials. If the contractor provides such invoice in duplicate, the person so appointed will sign and return it to the carter, if the quantity and nature of the materials are correctly stated thereon, and the production of such duplicate invoice, so signed, will be accepted by the surveyor to the westry as proof of delivery of the quan-tity of the materials signed for. The materials supplied may be measured by the surveyor to the vestry, or any person whom he may appoint, in the cart in which it is brought on to the works, or on the ground, as he thinks fit. If the measurement is found to be short of that stated on the invoice, the cost of measurement shall be paid to the vestry by the contractor. The materials are not to be considered as approved until they are used on the works.

Here follow the same clauses as to delay, payment, etc., as in the specification for blocks.

GEORGE R. STRACHAN, Surveyor to the Vestry. March 3, 1886.

Specification for the supply and delivery of Portland cement, for paving portions of the streets known as King's Road and Pont Street, in the Parish of Chelsea.

I. Cement .--The cement is to be the best Portland cement, very finely ground, weighing 112 pounds to an imperial striked bushel, capable of sustaining a breaking weight of 420 pounds per square inch of sectional breaking area after seven days' immersion in water. It is to be delivered in sacks containing two bushels, each bushel weighing 112 pounds net.

2. Quantity and delivery.—The contractor is to supply 5,000 sacks of cement, of which 2,660 are to be supplied to King's Road, from Limerston Street to Lot's Road, and 2,340 to Pont Street, but the vestry reserve the right to take a less number or to require the supply of a greater number. The sacks of cement are to be delivered on the streets named at any part thereof or on any of the side streets named at any part thereof, or on any of the side streets within thirty yards of such streets, and are to be stacked in such manner and at such times and places as the surveyor to the vestry shall direct. The contractor will be required to deliver the cement in lots of 500 sacks at a time, and to complete the delivery of each lot within seven days after the order is given. The order for the first lot will be given on the 10th March inst., for the second lot on the 11th March inst., and for the remaining lots at intervals of about seven days from the 11th March inst. The surveyor to the vestry shall have power to increase the length of these intervals, or to suspend the delivery of the cement on giving twenty-four hours' notice to the contractor, as he thinks fit, without any charges which may arise in consequence, being chargeable to the

3. Testing and approval.—When each lot is delivered, the vestry will watch and cover it at their own expense until it has been tested. The surveyor to the vestry will cause samples of each lot to be taken and tested as to its breaking weight, and will cause other samples of each lot to be weighed and measured. If the samples so taken comply with clause of of this specification, the lot from which they were taken will be approved by the vestre and which they were taken will be approved by the vestry and their surveyor, and the expense of the tests and measurements will be borne by the vestry. It, however, they fail to comply with clause I of this specification, the lot will be rejected and the contractor shall, at his own expense,

remove the cement within forty-eight hours after notice of its rejection from the surveyor, and shall pay to the vestry the cost incurred by them in testing and measuring the lot so rejected. If the contractor fails to remove such

cement the vestry may do so at his cost.

4. Sacks.—The contractor is to bring an invoice with each delivery of cement stating the number of sacks sup-plied in such delivery, which is to be left with the person appointed by the surveyor to the vestry to receive the cement. If the contractor provides such invoice in duplicate, the person so appointed will sign and return it if the number of sacks delivered is correctly stated thereon, and the production of such duplicate invoice so signed will be accepted by the surveyor to the vestry as proof of delivery of the number of sacks of cement and of the sacks stated thereon. The empty sacks will be returned to the contractor on the works as the cement is used, and are to be removed and signed for by 1 im at his own cost within twenty-four hours after notice from the surveyor to the vestry. The vestry will not make any payment for the use of the sacks, but will pay the sum of one shilling for every sack not returned within two months after its delivery on the works.

Here follow the same clauses as to delay payment, etc., as in the specification for blocks.

GEORGE R. STRACHAN,

March 3, 1886.

Surveyor to the Vestry.

(To be continued.)

THE PROTECTION OF PILES FROM LIMNORIA AND TEREDO.

BY MARSDEN MANSON, MEM. AM. SOC. C E.*

In June, 1882, ninety-nine piles, prepared by various methods to protect them from the limnoria and teredo, were driven in Mission Street pier, then being constructed at San Francisco. After an exposure of five years and four months one or more of the piles prepared by each method and four unprepared, with bark left on, were removed for examination.

The following is a brief description of the different modes of treating these piles and the results:

A. W. Von Schmidt prepared two piles by jacketing the driven piles with sewer-pipe and filling the space between the pile and pipe with concrete or grout, composed of sand, gravel, and Portland cement, costing 75 cents per lineal foot, or \$30 per pile. The pile examined was only attacked by teredo where two sections of sewer-pipe had been broken, and had lost thereby one-fourth or one-fifth of its original strength.

F. Shay's process cost 25 cents per foot, or \$10 per pile. His method was a modification of the Culver process, which is a covering of asphaltum and burlap. The modification consisted in the substitution of wire cloth for the burlap. A coat of asphaltum was applied to the pile, which was then wrapped with wire cloth, then another coat of asphaltum was applied and sprinkled with sulphate of lime. The piles removed broke in drawing. Only a trace of the covering was left.

J. McKeon & Co.'s process of coating the piles with marine cement was worthless.

W. H. Raye's process of covering piles with Portland cement and some secret ingredient was also worthless.

Pearce & Beardsley's coating was another modification of the Culver process, and consisted of a covering of burlap saturated with a mixture of naphtha and carbon bisulphide, with a small proportion of limestone, kaolin, sawdust, and sulphur. One pile removed was practically destroyed. There were driven on the westerly portion of this pier at the same time two unprotected cedar piles which were only slightly attacked.

The coatings applied by the various experimenters which depended upon adhesion to the piles utterly failed to afford even the protection given by the bark. Of the eight piles removed which had been coated by the Shay, McKeon, Pearce & Beardsley, and the Raye methods, but one retained sufficient strength to permit its removal without breaking, and this one was more severely attacked and damaged than any of the unprotected piles which were

mr. F. Collingwood, in discussing the paper, mentioned a pier that had been built at Newport News, Va., with unprotected piles, and the worms went through them in every direction; now the owners are expending more than every direction; now the owners are expending more than the whole cost of the original pier in substituting creosoted piles. They are using a wood creosote which the Government endorses, but it does not appear from experiments to be quite all that was claimed for it. The substance which is most effective as a preservative is said to be "dead oil." There is a decided difference between the taste of the dead-oil creosote and that of the wood-oil creosote. The bitter principle which the taste detects is said to be the important element in repelling the worms. The paper was also discussed by Messrs. Flagg, Thompson, Bogart, and Striedinger.

*Abstract of a paper read before the American Society of Civil Engineers, December 7, 1887.



THE WATER-SUPPLY OF BOMBAY.

WE reprint below an interesting article from the Engineer, by Mr. Killingworth Hedges, M. I. C. E., on the Tansa water-supply of Bombay, to which reference was made on page 349 of Volume XVI., and have reproduced the illustrations from the same source:

"I have britfly referred to this important scheme, which it is calculated will afford a water-supply for the city of Bombay amply abundant for all future requirements, and it is calculated will afford a water-supply for the city of Bombay amply abundant for all future requirements, and now propose to give some details of the work, which is in active progress under the superintendence of Mr. W. Clerke, C. F.., whose designs are being carried out. From the site of the dam to the boundary of the island of Bombay the distance is 53½ miles; the water will be conducted by gravitation from one point to the other by tunnels 2½ miles long, conduits 26¼, and iron pipes for the remaining 24¾ miles. The capacity of the tunnel and conduits as designed is sufficient to deliver 33,000,000 gallons daily, or about forty-five gallons per head—in addition to all the present sources of supply—according to the population of Bombay returned in the last census. It is not intended to utilize these large conduits and tunnels to their full capacity at present, and it has been decided to lay a single line of 48-inch iron pipes and raise the dam to a height which will give a supply of 17,000,000 gallons of water daily, without exceeding a fall of six inches per mile for the conduits and tunnels. The area of the artificial lake at Tansa, which is being formed by impounding the water of the Tansa River and building a dam in the first instance 118 feet high above the river bed, will be 8 square miles; the area from which the rainfall is collected is over 52 square miles, and all sources of impurity, such as villages and houses, are being removed from this district, The rainfall of the Tansa valley is on average about 100 inches, and Mr. Clerke estimates that the available run-off would be one-third of the rainfall, and states that after making allowances for evaporation and absorption, there will be sufficient storage to provide for a supply of 60,000,000 gallons per day for a whole year. In absorption, there will be sufficient storage to provide for a supply of 60,000,000 gallons per day for a whole year. In order to impound this vast quantity of water, a masonry dam of exceptional size has been designed, which will be 8,500 feet long, 100 feet wide at base, and 12 feet at top; the greatest height, where it crosses the bed of the Tansa River, is 118 feet. The drawing, Fig. 1, shows the sec-

10 5 0 10 20 30 40 50 60 70 80 90 100 11c 120 SCALE OF FFFT - RANKINE'S DAM B-LIVERPOOL WATERWORKS C-TANSA WATERWORKS 62.75 FIG.1 56.20 106 80 5.80 109.20 \$10.75 155.93 SECTIONS OF TANSA AND OTHER DAMS

tion of Mr. Clerke's dam and also the relative cross-sections

tion of Mr. Clerke's dam and also the relative cross-sections of the dam projected by the late Professor Rankine, who was consulted when the water-works scheme was originally proposed, also the dam which is being erected for the Liverpool Water-Works. The sections of each dam can be identified by referring to the lettering C, A, and B.

"It will be seen that Mr. Clerke's dam provides for considerable saving in material compared with that of Professor Rankine; special arrangements are also designed for carrying off the surplus water by means of a waste weir 1,800 feet long, also for drawing off the supply from the lake. The outlet works are shown in plan and elevation in Figs. 2 and 3. Figure 4 is an enlarged plan of the weir 1,800 feet long, also for drawing off the supply from the lake. The outlet works are shown in plan and elevation in Figs. 2 and 3. Figure 4 is an enlarged plan of the outlet, which consists of a pair of sluiceways G and H, each 2'5"x2', which are cut through the solid rock itself, which rises to this level. These sluices are closed by castiron gates worked by screw-gearing from top, and they are fixed on the inner side of the dam and discharge into a circular cistern, from which the duct will lead off These circular cistern, from which the duct will lead off These two sluices, with only one foot of head, are sufficient to draw off the greatest quantity of water that will ever be required, and nothing further would be necessary were it not for the desirability of drawing off from different levels, according to the level of the water in the lake. For this purpose it is intended to use a single sluice of the same pattern at two other points where the rock foundations are at a convenient height from the top of the dam. Figures 2 and 3 show the position of these sluices, which each discharge into a small square cistern connected with the abovementioned circular cistern by a masonry channel built along mentioned circular cistern by a masonry channel built along the outer toe of the dam, as shown in Figure 2. The upper sluice is to be used until the water falls to such a level that the sluice does not discharge sufficient quantity;

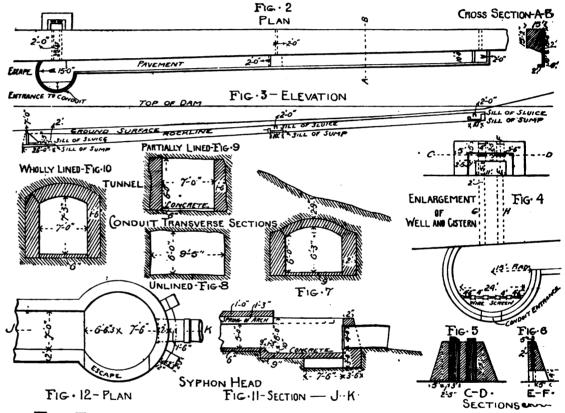
it will then be supplemented by the middle sluice, and in a similar manner the lower sluice may be worked when the level of the lake falls below that of the middle one. upper sluice would be exposed every year, and could be examined and kept in perfect order; probably the middle sluice would also be exposed or could be got at, but in order to obtain access to the lower sluices a well is built order to obtain access to the lower studes a well is built round them as shown in Fig. 4, which communicates with the lake by two openings, each 4x4 feet. Should it be desired to examine the sluices these openings can be closed by needles or vertical bars of timber 4x4 inches, let down through grooves left in the well for the purpose, as shown in Figs. 5 and 6, which are sections at C D and E F on

Fig. 4.

'In calculating the strength of the dam Mr. Clerke has used M. Bouvier's methods; the maximum pressure on Jused M. Bouvier's methods; the maxinum pressure on the down-stream face is 125 pound per square inch, and according to M. Bouvier's calculations, masonry built of good hydraulic mortar after it is ten years old may be safely subjected to a pressure of 187 pounds per square inch, which gives a good margin of stability even if the dam be raised to its final height of twelve feet above what will be the present elevation.

"The duct leads off from the circular cistern, which re-ceives the water from the outlet sluices. This duct, for the greater part of the distance, has been laid out as a conduit so as to minimize the amount of tunnelling. The transverse section of the conduit is shown by Fig. 7, and

line of piping, where it joins the conduits, the junction will be formed by a masonry cistern or syphon head, 15 feet in diameter, as shown by Figs 11 and 12, from which the pipe will take off at its head and discharge at its tail. feet in diameter, as shown by Figs 11 and 12, from which the pipe will take off at its head and discharge at its tail. A sluice-valve has been designed to work inside the syphon head by which the supply can be cut off in event of the pipe bursting, and each cistern is provided with an overflow or escape for passing off water to the nearest 'nalla,' or natural watercourse, in the event of the syphon-valve being closed. For laying the lines of pipes up and down the steep sides of the hills which are found between the head works at Tansa and Bombay, special precautions are being taken. At short intervals the pipes are built into heavy pillars of masonry, founded on hard ground, so as to prevent sliding or creeping. Scouring-valves and air-escape valves are provided at the principal depressions and summits along the lines of pipes. The head of water in the different lines of pipes differ considerably, varying from 104 feet to 256 feet. Where the maximum head exceeds 190 feet, the thickness of the pipes is 1½ inches; where less than 190 feet, 1½ of an inch is considered sufficient. Of the total length of waterway from the Tansa Lake to the reservoir to be constructed at a terminal point 48½ miles off, 28¾ miles will consist of tunnel and conduit, and 19¼ miles of syphon pipes. The only engineering work of importance on the line of main is the bridge which will carry the pipe across the Bassein Creek, and this is now being erected. The piers and



FOR THE WATER SUPPLY OF • THE TANSA WORKS BOMBAY .

will necessitate about ten feet of cutting to the floor. The cross-section is seven feet wide with five feet depth of water; the fall_is six inches per mile, and its discharging capacity—using Busin's coefficient—is forty-eight cubic feet per second, which is equivalent to twenty-six million gallons per day. The conduits will be provided with manholes every 220 yards, and with means of washing out and scouring at convenient places about half a mile apart. Some tunneling on the line of duct is unavoidable—that is, the length of conduit which would be required to avoid it would be so much in excess of the length of tunneling will necessitate about ten feet of cutting to the floor. is, the length of conduit which would be required to avoid it would be so much in excess of the length of tunneling as to be more costly. The tunnels when lined will have the same width as the conduit, but will be a foot higher. Where lining is unnecessary the cross-section will be 9.5 feet wide by six feet high; the fall will be six inches per mile, and the discharging capacity 33,000,000 gallons per day. Cross-sections of the tunnel are shown by Figs. 7, 8, 9, and 10. Where the line of duct crosses valleys it will consist of cast-iron pipes forty-eight inches in diameter. 8, 9, and 10. Where the line of duct crosses valleys it will consist of cast-iron pipes forty-eight inches in diameter, with a fall at the rate of 3.20 feet per mile. The discharging capacity of this pipe, according to Eytelwein's formula, is 17,000,000 gallons per day. In calculating the rate of discharge Mr. Clerke has used the method of Mr. Fanning, C. E., of Boston, U. S. A., who has studied the question of relative discharge of new and old mains. The amount when clean would, according to this method, be 21,500,000 gallons per day; slightly tuberculated, 20,500,000 gallons; foul, 19,500,000 gallons. So that the discharge from the ordinary formula of 17,000,000 gallons is quite on the safe side. The main is being laid entirely above ground; where an embankment has to be constructed, a width sufficient for two 48-inch mains is provided for, ground; where an embankment has to be constructed, a width sufficient for two 48-inch mains is provided for, allowing for a space between, as it is intended to lay down a tramway to facilitate carrying the pipes, and in the case of a pipe bursting, renewals from the nearest depot of spare materials. At the commencement and head of each

abutments consist of cast-iron cylinders five feet in diameter, filled with concrete, and sunk to a foundation in the river-bed, which, for some of the cylinders, was not reached until 60 feet below the low-water level. These cylinders until 60 feet below the low-water level. These cylinders support lattice girders, with rolled joists placed across so as to carry one line of pipes now, with ample space for a second to be added. In all there are three bridges across the creek, of respective lengths of 400 feet, 1,500 feet, and 400 feet, the height being sufficient to allow of the barges, which use the navigation, passing under. It was originally intended to carry out the erection of the dam departmentally, instead of by contract, but the latter plan has been adopted, the work, however, being directly under the superintendence of the consulting engineer, who has the superintendence of the consulting engineer, who has a residential staff, who, besides directing the work, examine materials employed, and daily test the mortar, which is most carefully made to the engineers' specification."

ANNUAL REPORT OF THE BOARD OF HEALTH OF THE CITY OF TOLEDO FOR THE YEAR 1886. This report is made by the Health Officer, Dr. C. L. Van

Pelt, who states that the general health of the city has been excellent, and reports the annual death-rate at 12.89 per 1,000, based upon a city census giving a population of 72.504, the total number of deaths for the year having been 935. This is an extraordinarily low mortality. The summer of 1886 was very favorable to the health of infants, and Toledo has almost no tenement-house population, which in part accounts for such a small death-rate. We do not learn much from this report as to the condition of municipal sanitation; it is stated that the sewers need ventilating and flushing and that the recommendations made in former

reports need attention as much as they did a year ago.

The expenses of the Health Office for the year were

ST. LUKE'S HOSPITAL, CHICAGO.

THIS hospital, which is considered one of the best of its kind in Chicago, was erected a few years since from the plans of Messrs. Treat & Foltz, architects, of that city. The plans we present herewith were copied directly from their drawings, and show the building as it will be when entirely completed. At present there is but one wing for wards.

The building faces the east, overlooking Lake Michigan, but separated from it by the broad lines of tracks of the lake shore roads. The entrance for patients is in the basement at the end of the long corridor. The entrance for visitors and the management is in the north-east pavilion, by means of a broad flight of steps leading directly to the first story. This wing contains the rooms for bathing, etc., in the basement, the reception and council rooms in the first story, matron's and female nurses' private rooms in the second story, rooms for the male help in the third, and in the fourth story is a large clinical amphitheatre, with ether-room, waiting-rooms, etc. This wing also contain the elevator, which is large enough to admit the longest stretcher, and is moved very slowly. There is a private stairway from the first story to the amphitheatre at the top of the building, besides a larger flight for the use of the nurses and patients.

This central wing, towards the north, contains the general kitchen, pantries, and store-rooms in the basement. In the first story are the dining-rooms, with separate accommodations for the officers, the nurses, and the help. The serving-room is connected with the kitchen by a pri-



vate staircase. A sitting-room for the nurses is also provided on this floor. In the story above is a sewing-room, a writing-room, a prettily finished chapel, giving 110 sittings, and a well-stocked library; all for the use of the inmates of the hospital.

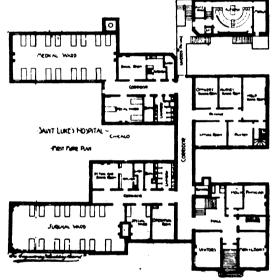
The north-westerly wing contains the fuel-rooms in the basement. Above is the morgue, in connection with a demonstrating amphitheatre, with a small waiting-room for the physician in charge. In the second story is the laundry, with a lift from the basement.

The easterly ward wing will have the dispensary in the basement when completed; also, the waiting and examining rooms for applicants, the offices, an accident room, a druggist's room and stores. In the basement under the other wing all of these departments are at present accommodated, with the exception of the accident-room, for which no provision exists. The final plan contemplates the allotment to this portion of the building of the stores, clothing and linen-rooms for the use of the wards, together with a few sleeping-rooms for the help.

The wards are in two stories, each exactly alike, and as shown by the plans. Each ward has connected with it in the same wing, a sitting and dining-room, a ward kitchen, a linen-closet, lavatories, and a ward for special cases, provided with three beds. The surgical wards are arranged for fourteen beds, and the medical wards for fifteen beds, disposed as shown on the drawings, with one window to two beds. The first-story wards are 15 feet high in the clear, and the second story 16 feet 6 inches. The windows are set up 2 feet 8 inches from the floor, and are made with an opening in the brick-work 4 feet I inch wide, the height of the windows being 11 feet 7 inches. This includes 20 and 22 inch transoms. The outside walls are of brick, built with a central air-space and plastered on

the inside. The ceilings are plastered on wire netting. The plaster-work is tinted in water-colors only. All floors are deafened by a plaster filling between the beams, and the wards are further isolated from each other by the ceiling in first story being furred down so as to leave a clear height of ten inches, this space being utilized in connection with the ventilating-pipes. All corners and angles in the wards are rounded.

The heating of the wards is entirely by steam. Under each window is placed a coil of pipe connected with a fresh-air inlet from out of doors, measuring 14% inches by 22 1/2 inches. This appears to be the only provision made for the introduction of warm, fresh air. For the evacuation of the vitiated air there are openings in the floor under each bed, which are covered with a wire cap raised slightly above the floor. In the space between the floors is a system of ducts connected with the exhaustregisters, and delivering into the large chimney at the corner of the ward, the draft being maintained by the heat from the metal boiler-flue which is carried up in the centre of the chimney. As the space between the floor is only ten inches high, it follows that ten inches is the greatest depth possible for the exhaust ducts, and, according, the ventilating pipe where it enters the chimney has a section of 10x134 inches. The area of the medical ward is about 1,660 square feet. The united sectional areas of all the thirteen outlets is 1,560 square inches, but this area is reduced to 1,340 square inches where the ducts unite to enter the chimney. This is about half the united areas of the inlets under the windows. The exhaust is, however,



supplemented by a large ventilating opening in the wall of the chimney 2x5 feet, and also by the twelve gas-brackets, each of which has a ventilator over it delivering into a flue in the wall.

Two additional stories were added to the west hospital ward during the past summer to be used for small rooms, for the directors, nurses, etc. This was in opposition to the advice of the architects, and the discussions which arose on the subject were so animated that several of the best physicians on the Board of Directors resigned when it was decided to make the addition. The ground was taken that it was contrary to the best principles of hospital planning to build the wings so high when they are placed so close to each other.

The fire-escapes are placed in the angles of the ward wings at the end of the passage leading from the main corridor.

The entire cost of the hospital, as at present completed, is \$145,000. It is estimated that with the new wing the total cost will be about \$190,000. This includes \$26,000 for the work of heating and ventilation, which was done under contract by Bartlett, Hayward & Co., of Baltimore.

Externally the hospital is built entirely of brick. .The location makes any architectural display impracticable, but the design is treated in a simple, quiet manner which is perfectly satisfactory.

The most successful feature of the building is the plan, which is very well adapted for its purpose, giving cross ventilation and plenty of sunshine all the day in the sick wards, and grouping on the north the offices, dissecting-rooms, kitchens, etc., for all of which sunshine is not such a vital consideration. Again, it is well planned in the manner in which the wards are separated from the rest of the building, allowing for an outside door and window immediately beside the entrance to the ward.

THE ENGINEERS' CLUB OF ST. LOUIS.

THE club met December 21, 1887, with President Potter in the chair, Secretary William H. Bryan, and thirty members and two vistors present. The following officers were announced to have been elected at the last meeting: President, M. L. Holman; Vice-President, J. A. Ockerson; librarian, J. B. Johnson; Secretary William H. Bryan; Treasurer, Charles W. Melcher; directors, William B. Potter and F. E. Nipher.

The new president having been duly inducted into office, called upon the retiring president for some remarks appropriate to the occasion. Professor Potter accordingly addressed the club on the present status of the profession and of the Engineers' Club of St. Louis in particular. His remarks were largely historical and he suggested the appropriateness of celebrating the twentieth anniversary of the club's formation, on November 4, 1888, by a social reunion of some kind. A printed catalogue of the club's literature was suggested. The benefits resulting from the Association of Engineering Societies and the journal, with its index department, were referred to. While a closer union of engineering societies might not yet appear desirable, he pointed out a number of ways in which cooperation might result in benefit to all.

A vote of thanks was given Professor Potter for his address, which was ordered published. The address was discussed by Professor Johnson, Messrs. J. A. Seddon, Flad. and Holman.

The secretary then read a paper by Mr. Isaac A. Smith on "Rapid Railway Embankment Construction," being an account of the construction of an embankment in North St. Louis containing 97,500 cubic yards, within a period of sixteen days. The material was river silt and the cost 18.58 cents per cubic yard—but little more than half of the lowest bid received from contractors, none of whom would give a time guarantee. Messrs. Bryan and Wheeler took part in the discussion, in which it was shown that the skrinkage six months after was II per cent.

Professor Engler called attention to an ingenious model of the hyperboloid of revolution.

Papers by Charles H. Ledlie and Professor Charles C. Brown were announced for the next meeting, January 4, 1888

THE CANADIAN SOCIETY OF CIVIL ENGINEERS.

The Canadian Society of Civil Engineers will hold their second general annual meeting January 12, at Montreal, on which occasion the retiring President, T. C. Keefer, Esq., C. M. G., will deliver an address. Half-fare return rates have been granted over the Grand Trunk, Canadian Pacific, and Intercolonial Railways. Full fares will be required to Montreal, and free tickets will be issued for the return journey. Henry T. Bovey is Secretary and Treasurer.

OHIO SOCIETY OF SURVEYORS AND CIVIL ENGINEERS.

THE ninth annual meeting of the Ohio Society of Surveyors and Civil Engineers will be held at Columbus, O., January 10, 11, and 12, 1888. Persons securing a certificate from a ticket agent that they have paid full fare to the meeting can obtain a return ticket at the rate of one cent per mile, provided there is a total attendance of 100.

W. H. Jennings, of Columbus, is President, and Benjamin Thompson, of Urbana, is Secretary. The following are chairmen of committees: On Legislation, E. B. Opdycke, Bryan; On Code, William Reeder, London; On Surveying, J. D. Varney, Cleveland; On Civil Engineering, C. A. Judson, Sandusky; On Drainage, E. D. Shreve, Mansfield; On Highways, D. W. Pampel, Sidney; On Blanks and Instruments, E. D. Haseltine, Haselton. The following papers will be read:

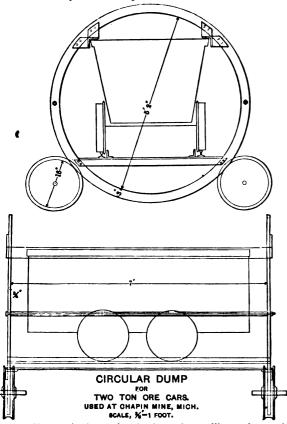
"Judicial Functions of Surveyors," Homer C. White, Warren: "Protection from Incompetency," George R. Gyger, Alliance; "The Public Domain," J. T. Buck, Cardington; "Adverse Possession," E. D. Haseltine, Haselton; "Steel Tapes as Standards." Professor J. B. Johnson, St. Louis, Mo.; "Road Making Materials of the State," Dr. Edward Orton, Columbus; "A State Topographical Survey," J. A. Hanlon, Massillon; "Philosophy of Underdrainage," Jonathan Arnett, London; "Catfish," Frank M. Kennedy, Washington C. H.; "Comparative Cost and Efficiency of Tile Drains and Open Ditches," E. B. Opdycke, Bryan; "Irrigation in Kansas," J. S. Humphrey, Garden City, Kan.; "Two-



Mile Assessment Pikes," E. W. Dimock, Ottawa; "Construction of Turnpikes," G. S. Innis, Columbus; "Notes on Paving," Thomas R. Wickenden, Toledo; "Cleveland City Pavement," M. E. Rawson, Cleveland; "Street Crossings and Sidewalks," R. A. Bryan, Portsmouth; "Street Grades and Monuments," Charles S. Lee, Marysville; "Monumenting," F. Hodgman, Climax, Mich.; "Street Grades and Records," W. H. Jennings, Columbus; "Construction, Maintenance, and Repairs of Short Span Highway Bridges," S. A. Buchannan, Bellefontaine; Computation of Strains in Highway Bridges," C. N. Brown, Columbus; "Bridge Details," H. T. Lewis, Columbus; "Thacher's Slide Rule," H. T. Lewis; "Lifting and Moving of Bridges," Thomas H. Johnson, Columbus; "Pile Foundation," Julian Griggs, Columbus; "Masonry as Applied to Railroad Work," E. G. Pugh, Columbus; "Puzzles for the Engineer," W. A. Guin, Sidney; "Water-Works Construction," J. B. Strawn, Salem; "Circleville Water-Works," W. C. Row, Circleville; "Springfield Water-Works, William Sharon, Springfield; "Mortar," B. F. Bowen, Columbus; "Difficulties of Surveying in the Virginia Military Tracts," William Reeder, London; "Landscape Engineering," John L. Culley, Cleveland; "Duplication of Drawings," Joseph N. Bradford, Columbus; "Railroad Location," S. F. Rock, Mt. Sterling; "Outfit for Railroad Survey," Benjamin Thompson, Urbana, all of Ohio, unless otherwise stated.

REVOLVING DUMP-CAGE.

WE take the following description and illustrations from the Enginee ing and Mining Journal, to which they were furnished by Mr. Per Larssen, the engineer of the Chapin Mine, in Michigan, who had seen the device used in Germany. It is not patented.



"The principle of this dump is readily understood. When the loaded car is standing in the cage, the centre of gravity is a little above the centre of the circle, and it is very easy to start this revolving on the wheels which support it. The load is discharged out of the top of the car, and at once the position of centre of gravity is changed, so that, without stopping, the cage completes its full revolution and stops in its original position. The whole operation is very simple and quick. The car is held in position by the angle-irons running the length of the cage just over the car.

"Among the advantages claimed for the circular dumping-cage is the fact that the cars require no doors, being emptied by turning them bottom up, and they are consequently cheaper to build and more durable."

WEST NEWTON CITY ENGINEER'S REPORT FOR 1886.

The report of the City Engineer of West Newton, Mass., Mr. Alfred F. Noyes, gives the usual record of work accomplished. The recording and indexing of original plans of property in the city has become one of the recognized duties of his office, and its value is become ing more and more recognized.

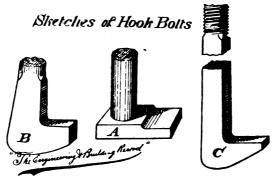
Record is made of a remarkable rain in February last six inches having fallen during the 11th, 12th, and 13th of that month, and in conjunction with a great depth of snow on the ground, which it carried away, caused a freshet of unusual magnitude.

The use of so-called coal-tar concrete (coal-tar and pitch mastic) sidewalks has become quite general, and the question of repair a serious one. Their life, under normal conditions, seems to be from six to ten years, by which time, from the loss of the volatile oils which they contain, together with the action of frost, settlement, roots of trees, etc., the surface becomes rough and unfit for use. The cost of maintenance per yard where no special repairs are made—in other words of entire renewals at stated periods averages for the best work about eight cents per year But if after the surface becomes slightly rough—say in one or two years—a thin coating of sand with tar or pitch be applied at about six cents a yard, or a thicker coat with some fine gravel if left three or four years at a cost of 35 cents, and such repairs be continued as required, the average cost of maintenance, including renewals, will be reduced to about four or five cents per yard. This course is recommended.

His remarks on experience under their new plumbing law are of interest, and we quote from them elsewhere in this issue.

A SIMPLE HOOK-BOLT.

THE turning around in place of round-iron hook-bolts when used to secure railroad ties to track stringers has occasioned great annoyance and much uneasiness as to the security of the floor systems of bridges and viaducts. Different forms of hook-bolts have been proposed to prevent this turning. They are generally expensive to manufacture, and the form of the iron is so changed in the smith shops as to make it doubtful whether it retains its original strength. The Manhattan Railway now use a bolt whose head is represented by sketch "A." The shoulder in the clip-head fits up against the stringer-beam and prevents turning. The head shown by sketch "B"



was designed by a Brooklyn gentleman. It is made square in section and intended to wedge into a round hole and up against the stringer; the square part is not long enough. The Union Elevated Railway Company, of Brooklyn, is using a form of hook-bolt, represented by sketch "C," in which a plain, square bar is turned up at the end without injury to the fibre. The other end is rounded and has a thread cut on it for a nut. This bolt is driven into a round hole of the same diameter as the side of the square, and will not turn under any ordinary provocation. It is possible that this simple bolt may have been used before; if so, we have not seen it. The bolts are, of course, used with the hook end up, and not as shown.

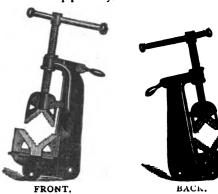
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

OPEN-JAW QUICK-SETTING PIPE-VISE.

THE novel feature about this vise is the rapidity with which the movable jaw can be adjusted for any size of pipe from one-eighth to two inches. This is done by raising the handle on the back of the vise, which opens the

nut through which the screw passes and permits the jaw to be placed at once in the desired position. The handle is then lowered, closing the nut, and a slight turn of the screw holds the pipe firmly.



Quick-setting bench vises are quite common, but we do not remember to have seen the principle applied to any pipe-vise of this pattern, and its utility as a time-saver is obvious.

It is made of steel, weighs ten pounds, and is manufactured by Clarence M. Kemp, of Fayette and Frederick Streets, Baltimore, Md.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York	Manhattan	Metropolitan	Mutual	Municipal	Krickerbocker	Equitable
	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light
	Company.	Company.	Company.	Company.	Company.	Company.	Company.
December 17	23.25	18.62	20 47	29.62	27.82	25.32	31.13

MESSES. BENDER & FRANCKEN have published in Annales Industrielles a new formula for making the conglomerate in Leclanche cells:

Binoxide of Manganese	 40	per cen
Graphite	44	**
Tar	 9	
Sulphur	 0.6	••
Water	 6.4	**

The mixture is reduced to a fine powder and subjected to high pressure in molds. The mass is then heated to about 350° Centigrade (662° Fah.), which evaporates the water and the most volatile portions of the tar. A part of the sulphur combines with the distilled products and the rest unites with the non-volatilized residuum which has an effect analogous to that of vulcanizing rubber.

LIGHTING CARS BY ELECTRICITY.

What may well be called the "burning question" of how to light railway cars lends interest to the following from the Chronique Industrielle of November 6. The passenger trains on the Stuttgart-Halle line are lighted by the Bernstein system of incandescent lights and Khotinsky accumulators. The accumulators are not connected with any electric source, although a dynamo is carried in the baggage-car. On account of this non-connection the lights are not subject to pulsations. The dynamo, during the run, charges a battery of accumulators, which can be used in case any of the batteries supplying the light in any car should lose its force or efficiency, in which case this extra battery could be immediately attached to it. Each car has two batteries of eight accumulators each, and each battery weighs 150 kilograms. The accumulators of each car are separate and entirely independent of the batteries in the other cars. The lamps are fixed to the car ceilings. Third-class cars have threecandle-power lamps. First and second class cars have from five to sixteen candle-power lamps.

ELECTRIC CAR-LIGHTING IN WURTEMBERG.

THE Wurtemberg Government has in practical use on some of its railroads the following system of electric carlighting.

The lights in each car are supplied from separate accumulators which are charged by a dynamo driven from the car-axle. Each car is thus entirely independent, and if the train is stopped or the cars uncoupled the lights are not interfered with. The management of the apparatus is said to be very simple.



THE LEGAL RELATIONS EXISTING BETWEEN WATER COMPANIES AND CONSUMERS.*

BY A. H. DENMAN, ATTORNEY, DES MOINES, IOWA.

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Company compelled to furnish water to those who apply.—
Water companies as they are generally, in not universally organized, belong to the class of quasi public corporations. They are private companies to whom the State has delegated certain of its powers for the purpose of enabling them to do a public work. The State grants the franchise for the benefit of its citizens, and such companies control therefore, refuse to supply all who were panies cannot, therefore, refuse to supply all who were intended to be benefited by that franchise. A water company stands in some sense in the position of a public officer authorized to administer to a certain public necessity, and is not privileged to make exceptions to the general provisions of the law which gives it its power. It is for such companies to yield their facilities to all who confor such companies to yield their facilities to all who conform to certain conditions and come within the intention of the statute, and for a higher power to determine who shall be the objects of that bounty. It is difficult to conceive of a work which comes more legitimately within the province of the Legislature or of municipalities than that of bringing a supply of water within reach of all or as many as possible of the inhabitants, and of affording facilities in the way of reservoirs water mains etc. of which many as possible of the inflatitants, and of anothing factities in the way of reservoirs, water-mains, etc., of which every one, by complying with reasonable requirements, may avail himself. But it would not probably be heat that the State alone can traffic in water to the exclusion of individuals. If the State should undertake to forbid of individuals. If the State should undertake to forbid any one from buying and selling water except those whom it might permit, or to whom it might give the exclusive right, it would indeed create a monopoly in the plainest sense of the term. But the State has certain powers which are peculiarly her own, and which she can delegate or not, as she sees fit. These things are not the legitimate subjects of private enterprise, and the delegation of these powers by the State to one or more parties to the exclusion of others is not obnoxious, as establishing a monopoly. Therefore, while the State may not, pera monopoly. Therefore, while the State may not, perhaps, forbid traffic in water by private individuals, it lies entirely with her to say whether one or more such persons, to the exclusion of all others, shall use the streets for the laying of water-mains, or condemn private property for the carrying on of their work, or who it shall contract with for the supplying of public buildings, sprinkling streets, etc. So whether or not a water company can be considered as a *quasi* public corporation, and therefore bound to supply all who reasonably apply to it, depends upon the fact of its acting in any sense for the State. To this end it is pertinent to inquire whether the State has upon the fact of its acting in any sense for the State. To this end it is pertinent to inquire whether the State has delegated any of its powers to the company, or given it any exclusive privileges in the use of its streets, etc., or given it the right to condemn private property, or in any other manifested the intention that the company should act for the State in supplying the public pages ities.

act for the State in supplying the public necessities.

In regard to gas companies it has been held that to be a public corporation, and liable as such, the company must have more than a mere license or permission, not exclusive, to lay its mains in the streets, nor would the additional fact that the company is the sole manufacturer of gas in a certain neighborhood, bind it to furnish gas to any or all persons longer than its convenience or caprice might induce it to do so. (1)

Consumers must comply with reasonable requirements.

—If the company is bound to furnish water to all who apply, it follows as a matter of course that it must do so upon reasonable terms. All rules and exactions on the part of the company which tend to deprive one of the privileges contemplated by the incorporation of the company which tend to deprive one of the privileges contemplated by the incorporation of the company which tend to deprive one of the privileges contemplated by the incorporation of the privileges which pany are, as far as they go, violations of the principle which has just been discussed. The company can no more insist upon an unreasonable exaction than it can unreasonable ably and capriciously refuse water to one who applies. The former differs from the latter only in degree and not in kind. On the other hand, the right to draw water from the pipes of a water company is property and is not to be demanded as an unfettered right. (2)

There is a corresponding duty on the part of the consumer to comply with all reasonable conditions—he must make demand on the company for water; he may be required to do so formally by coming in person to the office quired to do so formally by coming in person to the office of the company and there signing a written or printed application, and shall embody the contract between him and the company and bind him to submit to reasonable conditions imposed by the company; he may be required to pay in advance and to make a reasonable deposit to secure the prepayment of the rate for the future; to answer correctly questions concerning the probable number or rooms, size of premises, number of stops, etc.; (3) he must provide himself with proper plumbing and make it safe and free from leaks, (4) or else the company will have the

right to refuse the demand. Many other regulations growing out of the necessities of the case or the peculiar relations subsisting between the parties, will doubtless be upheld by the courts.

Where one makes his own private and suitable connections, he is entitled to receive water through them, and cannot be compelled by the company to take through other fixtures and share the expense in common with other perfixtures and share the expense in common with other persons. Thus, where one occupies apartments in a "model lodging-house," which is a building divided into distinct compartments for each family, and such person has his own separate and appropriate connections for supplying his own needs, the company has no right to insist on supplying the whole building through one system of pipes, and compel such person to take water and share the expense thereof in common with the other occupants of the house, any more than it would compel the occupants of a block of houses to take water in this way. (1).

The company may refuse to supply a person already

The company may refuse to supply a person already indebted to it or who refuses to pay the rate. (2). The contract between the consumer and the company is a personal one, and the occupant of a house cannot be charged with the water-rate defaulted by a former occupant of the same house. (3). So, also, where the tenant defaults his water-rate, and the landlord afterwards moves into the same premises, the company cannot refuse to supply the landlord because of the tenant's default. (4).

landlord because of the tenant's default. (4).

The consumer cannot compel the company to supply him with water as for a family purpose when he has provided his home with the fixtures of a much larger establishment. The fixtures must be adapted to the demands made upon the company. (5). The company may refuse to supply one until he does away with all fixtures except such as belong to the class of consumers among which he intends to be classed. For instance, where one contracts for water for family uses, which the status makes to intends to be classed. For instance, where one contracts for water for family uses, which the statute makes to include movable but not stationary bath-tubs, the company may refuse to turn on the water until the consumer disconnects entirely the inlet-pipes to his stationary tubs, but the company cannot refuse because the consumer will not disconnect his outlet-pipes as well. (6). Where the company is allowed to furnish water for family purposes at another. at one rate and water for all other purposes at another rate, it has a right to insist that the consumer make separate connections and attach a meter so that the company may ascertain how much water is used for other purposes than for the family.

As to whose duty it is to pay for the meter will be considered presently.

Although the company has an undoubted right to cut off the supply of a consumer because of non-payment of the rate where the consumer does not dispute the amount due, yet the company is not thereby made the sole judge of the amount due to itself. If the amount due is in dispute, the company may be enjoined from cutting off the water until the question is adjudicated, and it would seem from this that the courts would refuse to order the water turned on again after it had once been turned off by the company, until after the consumer can show just as conclusively that the claim the company has against him is baseless. (7). Nor can a meter be taken as conclusive of the amount due to the company, although approved, tested by arbitration according to statute, and found to work

In the case of Sickels vs. Manhattan Gas Company (8) an injunction was issued against the company, forbidding it from cutting off the gas from the house of S. On hearing of a motion to dissolve the injunction, testimony was ing of a motion to dissolve the injunction, testimony was that S., on going to Europe with his family, turned off the gas from his meter and pipes by a stop-cock in the cellar and within reach of any one in the house. The servants testified, and there was no direct attempt to impeach their testimony, that the gas continued turned off during the entire absence of S. and his family. But the meter indicated that a considerable quantity had been consumed meanwhile. The meter was admitted to be in good condition, and the company introduced testimony showing the impossibility of the meter's registering anyshowing the impossibility of the meter's registering anything unless gas passed through it. The Court held, however, that the above testimony was sufficient to cast a doubt upon the correctness of the meter, and refused to disturb the injunction until the question as to how much was due from S. to the company was settled by a judge ment at law.

- (1). Young vs. Boston, 104 Mass. 95. The "Model Lodging-ouse" in this case consisted of ten suites of apartments or tenements each one of which contained a sleeping-room, kitchen, and water-closet, and all the conveniences of a common dwelling-h There were no fixtures in the house used in common by the tenants. and no mechanical difficulty in the way of making separate connections or of attaching a meter to ascertain the amount of water used in each apartment. The apartments were not owned by tenants, but the whole building was owned and controlled by a corporation which had general charge of the building and control of the outer doors and halls. An ordinance of the city of Boston also made special provision for such tenements where they had separate water fixtures
- (2). Note 4 Am. & E. Corp. Cases 70. People vs. M. G. Lt. Co. 45 Barb. 136.
 - (3). Sheffield Water Co. vs. Wilkinson, 4 L. R. C. P. D. 410.
- (4). Dayton vs. Quigley 29 N. J. Eq. 77; Dillon Mun. Corp. 320.
- (5). Sheffield Water Co. vs. Carter, 8 Q. B. D. 832.
- (6). Sheffield W. Co. vs. Carter, supra. (7). Sickels vs. Manhattan Gas Co., 64 How. Pr. 334-
- (8). Sickels vs. Manhattan Gas Co., 66 How. Pr. 31.

In harmony with the principle of the case of Sickles vs. Gas Company, it has been held in Maryland that if a consumer owns two houses, and pays the price of the water consumed in one, but disputes his bill as to the other, the company will be enjoined from cutting off the water from the house paid for until the amount of indebtedness in dispute has been adjudicated. (1). It would seem to follow from this that if one owned several houses the company was refuse to furnish water to any of them until the consumer to any of them. may refuse to furnish water to any of them until the con-sumer satisfies his indebtedness as to all, it being admitted that he owed a debt to the company on any one of them. So, also, it would seem that if one became indebted to the company at one place and moved to another, the company may refuse to furnish the water until the first debt is discharged.

Measure of damages for refusal of water and for cutting off the same.—In Gas-Light Co. vs. Colliday, 25 Md., 1, it is held that to unlawfully break the pipe of a consumer connecting with a gas-main is a trespass for which damages are recoverable, and the measure thereof is the deterioration in the value of the premises for sale or rental, and the cost of removing the fixtures and restoring the premises to their former condition. In Shepard vs. Milwaukee Gas Co., 15 Wis., 318, where gas was wrongfully denied to a store, the plaintiff was allowed to recover for the damage done to his business which could be actually traced to this done to his business which could be actually traced to this cause, and also an allowance for the inconvenience and annoyance. The rule cannot be different for water companies, and may be briefly stated to be all the cost of restoring the premises to their former condition and allowance for all other losses in rents, profits, and disturbance of the enjoyment, which are directly traceable to the trespass.

In order, however, to claim damages the consumer must place himself in a right relation to the company, by making suitable connections and tender of the rate. (2.)

Where tender has, however, been once refused the consumer need not repeat the tender every month, or whenever his bill usually falls due. He has a right to presume that the tender is refused until the company notifies him to the contrary.

to the contrary. (3)

Obligation and liability of the water company in case of conflagration.—In the absence of express contract, a water company cannot be held liable in damages for the destruccompany cannot be held liable in damages for the destruc-tion of the premises of a consumer by a fire, which might have been quenched had the water been furnished, even though the company was at fault in not keeping up the supply. (4). Not only so, but the company may alto-gether refuse, in the absence of a contract, to furnish water for extinguishing a fire, although that may have been one of the objects of its incorporation. (5.) If the con-sumer appropriates for that purpose the water of the com-pany, which he has at hand, it is doubtful if the company could recover its value. If the company contracts to keep up a supply of water in the pipes at a certain pressure, with a view to quenching fires, it would, probably, under a familiar rule of the law of damages, be held liable at the suit of the other contracting party, who has been damaged, for all injury which could be clearly traced to the failure of the company to keep up the supply of water, according to its contract. to its contract.

to its contract.

When a municipality establishes reservoirs, hydrants, etc., of its own to provide against the spread of conflagration, it is not liable if the means provided are inadequate to the demand, which may be made upon them. (6.) The responsibility of a city for the precautions which it takes, to prevent public calamities, is political and not legal. No amount of neglect, on the part of the city, to avert these things will render the city liable. Where a city suffers its hydrants, reservoirs, and mains, built as a precaution against a conflagration, to fall into such a state of neglect and decay as to be useless, no action at law will lie for the damages caused by a fire which raged unchecked in consequence. (7). Such cases are very different from the case of damage caused by defective sidewalks, or the bursting of a carelessly constructed reservoir, which would give rise of damage caused by defective sidewalks, or the bursting of a carelessly constructed reservoir, which would give rise to actions of tort against the city. The fact that a private water company is under contract with the city to furnish water for the extinguishing of fires gives the private consumer no more hold upon the company. In such case the company is not liable to the consumer, because there is no privity of contract, nor the city, because the city has suffered no damage. The company can be held responsible only under its contract or to answer to the statutory penalty, if there is one, for failure to keep up the requisite pressure and supply of water in the pipes. (8).

- (1). Gas-Light Co. vs. Colliday, Shepard vs. Milwaukee Gas Co., upra, Sheffield Water Co. vs. Wilkinson, 4 L. R. C. P. D. 110.
- (2). Gas-Light Co. vs. Colliday, Shepard vs. Milwaukee Gas Co., supra, Sheffield Water Co. vs. Wilkinson, 4 L. R. C. P. D. 110.
- (a). Shepard vs. Milwaukee Gas Co., 15' Wis. 318.
- (4). Nickerson vs. Bridgeport Hydraulic Co., 46 Conn. 24; Atkinson vs. Newcastle and Gateshead Water Co., 46 L. J. C. P. 775; Blakeslee vs. St. John Water Co., 1 Allen (New Brunswick) 659; Campbell vs. East London Water Co., 26 L. T. N. S. 475.
- (5). Nickerson vs. Bridgeport Hydraulic Co., 46 Conn. 24.
- (6). Tainter vs. City of Worcester, 123 Mass. 311; Black vs. City Columbia, 19 South Car. 412; Van Horn vs. Des Moines, 63 la. 447; Brinkmeyer vs. City Evansville, 29 Ind. 187.
- (7). Grant vs. City Erie, 69 Pa. St. 420; Patch vs. City Covington, 17 B. Mon. 722.
- (8). Blakslee vs. St. John Water Co., x Allen (New Brunawick) 639; Atkinson vs. Newcastle and Gateshead Water Co., 46 L. J. C. P. 775.



^{*} This paper, read before American Water-Works Association Minneapolis in 1887, has since been published in pamphlet form by the author, who has consented to its publication in full in these columns .-- ED.

^{(1).} Hoddesdon Gas, etc., Co. vs. Haselwood, 6 Com. B. N. S., 239; Patterson Gas, etc., Co. vs. Brady, 27 N. J. Law, 245.

^{(2).} Philadelphia vs. Cook, 30 Pa. St. 56. (61)

^{(3).} Williams vs. Gas Co., 4 Am. & E. Corporation Cases 66. (See reporters' notes). Shepard vs. Milwaukee Gas Co., 15 Wis. 318. For a series of regulations held to be unreasonable, see Shepard vs. Milwaukee Gas Co., 6 Wis. 539.

^{(4).} Shepard vs. Milwaukee Gas Co., 6 Wis. 539; Sheffield Water Co. vs. Wilkinson, 4 L. R. C. P. D. 410.

Apportionment of charges for water furnished by companies or by the city.—There is no distinction in the law regarding charges for water between those made by private companies and those made by the city. As far as the private consumer is concerned both stand in the same relation. The power to collect charges for water consumed is a necessary incident of the power to furnish the water. The Legisiature has the same power to regulate the charges of a water company as it has to regulate those of any other public corporation. In California, however, when the former constitution required all corporations not municipal to be formed under general laws, it was held that the fixing of the rates of a water company was a franchise, and not being a general law applicable to all corporations, was void under the constitutional provision. (1.) The law regulating charges for water turns upon the law of sales. The courts all proceed consistently with the proposition that the water is a commodity which is bought and sold. It is the law of personal property and not of realty which applies. Water rents are not taxes, although the statute may in some cases give them some of the incidents of taxes, as, for instance, by making them a lieu upon the premises and enforcing collection as the collection of taxes is enforced. (2.) We have already seen that the contract of the consumer is a purely personal one except as the statute makes exceptions. Water-rates being a charge for value received, the charge cannot be made until the company is prepared to furnish the water (3), and where the supply is not so good nor so abundant as the company's contract calls for, the company may, nevertheless, recover a quantum meruit for what it has actually delivered. (4.) Back water-rents may also be collected as for value had and received. (5.)

The Courts will sustain any reasonable charge based upon any fair method of estimating the quantity of water used by the consumer, but where no water is had, no charge can be made. Hence, a town cannot impose a tax for water upon persons inhabiting premises not supplied with water-fixtures, and who do not take the water the town has to offer. (6.) Nor can a water rate be assessed against vacant lots (7), nor can a building, the lower part of which is used as a store, be charged as an occupied house, or as a place where people are living and presumably requiring more water, (8), nor can a house used as a lodging-house merely be charged for water as a hotel, more especially when the water does not rise therein further than the first floor (9), all of which is upon the sup position that the rate paid is for a commodity and not for a mere privilege, nor for the use or rent of something, nor as a tax. The above instances are, of course, to be carefully distinguished from general taxes levied to pay for water used by the city itself, and from assessments against property for the laying of water-mains, etc., in streets and highways

property for the laying of water-mains, etc., in streets and highways.

Discriminations in charges for water.—Aside from meters (which we shall consider presently by themselves), and other means of actually measuring the quantity of water consumed, various ways of estimating the probable quantity of water used are recognized and upheld by the Courts, and are in common use everywhere. The chafge for water may be based upon the use to which the premises are put, upon the number and size of rooms, number of persons occupying the premises, the number and size of the taps, area of the grounds, and other considerations which really tend to affect the quantity of water used. The different uses to which the water may be put upon the same premises may also be made a basis of discrimination. One may, for instance, be charged so much for the use of water for his domestic purposes and another rate for hose, garden, stable, or stationary-bath purposes. Where such discriminations are used, the charges must be consistent—domestic uses cannot be assessed, as something else which cannot be so included in the fair acceptance of the term.

Domestic Purposes.—Inasmuch as the quantity of water used for domestic purposes is seldom accurately gauged, but based upon a rough estimate, and as this distinction from all other uses is so universal, it becomes important to determine just what such uses include. Domestic purposes include cooking, drinking, washing of clothes, persons and premises of a family—in short, water as applied to the usual and ordinary conduct of family lite. (10.) Hose and the use of water for gardens are usually excepted by statutes, ordinances or rules regulating the charge from domestic uses, and would not probably, in any event, be construed to be such, nor can one, as we have already seen, draw a supply of water for family uses when he insists on maintaining fixtures calculated for the use of a larger establishment. The inhabitants of a work house or penitentiary are to be supplied as a large family, for although the purpose of such a building is public, the water supplied for the life and comfort of the inhabitants

- (z). People vs. Stephens, 62 Cal., 200.
- (2). Aumann vs. Elack, 15 W. Va., 773; Jones vs. Water Commissioner, 34 Mich., 273.
- (3.) Ex parte Dallimore, 11 Low. Can., 436.
- 14. Failes vs. LeMaire, 13 Low Can., 335.
- (5.) Girard Life Ins. Co. vs. Philadelphia, 88 Pa. St., 393; see also Clunes W. Co. vs. Winchester, r Victorean Law, 298.
- (6.) Allentown vs. Kramer, 73 Pa. St., 400.
- (7.) Provident Inst. for Savings vs. Allen, 37 N. J. Eq., 36.
- (8) Shaw vs. Quebec, 16 Low. Can., 541.
- (9.) Cromwell vs. Stephens, 3 Abb. Pr. N. S., 25.
- (10). Weaver vs. Corporation of Cardiff, 48 L. T. N. S., 906.

thereof is supplied for a family purpose. (1.) Not so, however, with a city-hall or court-house. (2.) While purposes connected with personal cleanliness are clearly included in domestic uses, this does not include stationary baths in a private house. (3.) This would seem to include stationary wash-tubs as well, although one who pays the charge for domestic purposes is thereby clearly entitled to all the water necessary for the washing of persons and clothing in other than stationary tubs. Where one is supplied with stationary tubs, but removes his inlet-pipes, the company can then no longer refuse him, although he removes neither the tub nor the outlet pipe. (4.) Stationary tubs are extra domestic more because of the facilities they give for the drawing of water than for their character of bath or wash-tubs. A private stable in which there were no water-fixtures has been held to be included in a charge for domestic purposes. (5.)

in a charge for domestic purposes. (5.)

In England it is common to assess the amount of water used by families according to the income of the premises. The charge may be assessed proportionately according to the rent the premises command, or according to the rate at which the premises are assessed for taxes, or upon the actual amount or annual value upon which the assessment to the poor's rate is computed in the parish or district. When the rate is based upon the "annual" this does not mean the same as the "annual value" of the premises. (6.) The annual rent is to be determined by deducting the taxes or rates which the landlord pays to the Government from the gross rent. When the houses are rented by the week and the wa'er-rent is assessed upon the annual rental, an estimated sum must also be deducted from the gross rent, sometimes called the "annual value," to allow for times when the premises stood idle, but the landlord or whoever pays for the water is not entitled to an allowance for repairs or for insurance. (7.) Value and "net value" are held to mean the same thing. "Gross value" is not value at all, but simply an incorrect expression like "gross profits." (8) Where the charge for water is based upon the "actual amount of rent," the company is entitled to assess the water-rate upon a percentage of the net rent which comes to the landlord free of taxes and all expenses usual to keep the premises in a state to command such rent. (6.)

Meters.—There can be no doubt that a water company or board, acting under general powers, has a right to assess the quantity of water used, at so much a gallon or one hundred gallons by actual measurement, and they have power to adopt any suitable means of measuring the quantity of water consumed, whether by meter or any other automatic arrangement that they see fit to adopt. In the case of Young against Boston, 1 Allen, 361, a hotel which had been paying an estimated rate was metered, and found to consume ten thousand gallons of water per day, for which the court held that it must pay a rate of two cents per one hundred gallons as assessed, although the aggregate was four times the amount paid for the hotel under the former arrangement, and but very few of the hotels in Boston were metered. But it is very doubtful, in the absence of statutory provisions, whether the company can compel a consumer to put in a meter at his own expense, or compel him to pay a meter-rent. In sheffield Water Company vs. Carter, 8 Q. B. D. 832, it was decided that the power to compel a consumer to rent or to purchese his own meter, could not be implied from a clause in a statute permitting the company to let meters for hire, nor could the company, which was empowered to lay water-pipes and "other apparatus," put in the meter and charge it up as a part of the "other apparatus."

In New Jersey it has also been held that while a water board acting under general powers have an undoubted right to assess a consumer according to meter, the board has no right to make him pay for the meter, nor for the rent thereof. (10). In Sheffield Water Company vs. Bingham, 52 L. J. Ch. D. 624, the question came up in this form: Who must measure the water consumed, the company or the consumer? It was there decided that the sale of water, as usually carried on, differed from usual sales of merchandise, in that the goods were not delivered to the consumer as he called for them, but it was put in his power to draw what he needed without the knowledge of the seller. Hence, it beig solely in the power of the consumer to know how much water he takes, he is the one who is bound to know and to measure what that quantity is and to account for it to the company. Although it was held that the company might not have the power to prescribe any particular form of meter or measure which the consumer must use, yet the consumer is bound

(1). Liskeard Union vs. Liskeard Water Co., 7 Q. B. D., 505; Spring Valley Water Co. vs. San Francisco, 51 Cal., 111; Hawes vs. Contra Costa W. Co., 5 Sawyer (U. S. C. C.), 288; San Diego W. Co. vs. San Diego, 59 Cal., 517; Spring Valley Water Co. vs. San Francisco, 61 Cal., 18.

- (2). Commercial Bank vs. New Orleans, 17 La. An. R., 140.
- (3). Sheffield Water Co. vs. Carter, 8 Q. B. D., 832.
- (4). Sheffield Water Co. vs. Carter, subra
- (5). Busby vs. Chesterfield Water and Gas Lt. Co., El. Bl. and El., 176.
- (6). Sheffield Water Co. vs. Bennett, 8 L. R. Ex., 196, affirming S. C. 7 L. R. Ex., 409.
 - (7). Smith vs. Mayor, etc., 11 Q. B. D. 195
- (8) Dobbs vs. Grand Junction Water Co., 53 L. K. A. B. 50.
- (9). Dobbs vs Grand Junction Water Co., supra.
- (10). State vs. Jersey City, 2 Am. &E. Corp. C. 223; see also Shepard vs Milwaukee Gas Co., 5 Wis. 549.

to provide himself with some automatic arrangement which will accurately measure the quantity of water that he takes from the pipes. In this case, the defendant, who paid extra for a stationary bath-tub, determined by actual hand measure the amount required for a bath He then drew a line around his tub to indicate how far that quantity of water would rise therein. The family were forbidden to fill the tub above the line and were ordered to mark upon a calendar suspended in the bath-room each time the bath was used. This arrangement the court found to be neither adequate nor just to the company, and that the defendant must use some automatic means which would accurately register the amount of water used and not to put the company at the mercy of the forgetfulness or the deceit of any one who might form part of the consumer's household. The reader can hardly regard the above cases as settling very satisfactorily the question who shall pay for the meter. The rule, if any, fairly to be deducted from the weight of authority above discussed, would seem to be, that the party desiring to measure the water must furnish his own means to do so, whether he be the consumer or the purveyor. The question, Lowever, can hardly be regarded as settled. As the population becomes more dense these relations will become better defined. The practical difficulty with water companies furnishing meters to their small consumers lies in the fact of the useful cheapness of the water and the expensiveness of the meter. And yet the enormous waste caused by large numbers of small consumers is often a very serious matter and very hard to regulate; indeed, as the matter now stands, it is to a degree impossible for the purveyor to enforce the care and responsibility he has a right to demand from the consumer. This would be almost wholly obviated by the use of meters. Then in that case, if the consumer neg-lected his plumbing or his faucets, appropriated the water to uses he is not charged with, or allowed his neighbors, who are not consumers, to steal from his pipes, his own wrongs would come upon his own head. It would seem to be but reasonable that as the consumer is compelled to make suitable connections adapted to his demand upon the company, that some form of automatic measure should be included as a part of the necessary plumbing arrangements of the house. The company, it would seem, ought not to be compelled to furnish such fixtures to the innumerable connections which are made with their mains, or else be be left to so large an extent at the mercy of the fraud, deceit, and neglect of tenants. The company ought not to be compelled to furnish the meters any more than

many other items of plumbing it has a right to demand that the consumer shall be supplied with.

If the consumer is not satisfied with the charge made against him as being in excess of the legal rate, there is some intimation in Young vs. Boston, supra, that he may ascertain the true amount due from him by meter and tender the proper charge according to the water actually consumed. There seems to be nothing to prevent the consumer's attaching his own meter or other approved means of ascertaining what he actually takes, and making tender in accordance therewith. This, however, does not apply to one already under contract with the company or city, and who has agreed to pay for what he has a right to take. He cannot then come and compel the company to accept the smaller rate because he did not use enough to justify the amount he has agreed to pay. But it would seem reasoning from principles already laid down by the courts, that the company cannot compel a person to enter into a contract compelling him to pay for more water than he intends to use, and that the consumer is justified in tendering a sum which shall be a fair charge for what he actually takes, and shall tully compensate the company for all the labor and expense of supplying h m. The company have, as we have seen, an undoubted and an unqualified right to attach its own meters and insist in apportioning the charge at so much per cubic foot, barrel or one hundred gallons, or any other suitable unit of measure it chooses to adopt. The courts have not gone very far in deciding these questions. Farther unfolding and application of the law to these matters may be confidently expected from different sources in the near future as the need increases that these relations be more strictly defined.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE thirty-fifth annual meeting of the society will be held in New York, on Wednesday, January 18, 1888, at 10 o'clock.

The annual reports will be presented, officers for the ensuing year elected, time and place for the next annual convention considered, reports of standing committees presented, proposed amendments to Constitution and By-I.aws discussed, and other business transacted.

It is expected that the business of the meeting will be transacted during the first day; a lunch will be served at the Society House. Arrangements for the evening of Wednesday, January 18, and for the day and evening of Thursday, January 19, will be perfected by a committee, and will include visits to points of interest, and a dinner or social reception.

or social reception.

The following persons have been selected as candidates for officers by the Nominating Committee: For President, Thomas C. Keefer: for Vice-Presidents, J. James R. Croes, Robert Moore; for Secretary and Librarian, John Bogart: for Treasurer, George S. Gieene, Jr.; for Directors, Mendes Cohen, Joseph M. Wilson, Stevenson Towle, Charles B. Brush, Alphonse Fteley.





HOT-WATER HEATING AND FITTING. BY "THERMUS.

No. XIII.

(Continued from page 465.)

EXPERIMENTS ON THE VALUES OF HEATING-SURFACE, ETC.

To go further with this subject, I will refer to experiments of Mr. Hood made more recently than Mr. Tredgold's, as he was not satisfied with the latter's deductions and made experiments for himself. In his work on "Warming and Ventilation" he tells us that "to ascertain the velocity of cooling for a surface of cast iron, a pipe 30 inches long and 21/2 inches internal diameter and three inches diameter externally was used. The ends of the pipe were closed by corks, which entered the pipe 11/2 inches at each end, and the bulb of the thermometer was inserted into the water about three inches from one end. The exposed surface of the pipe (including the surface exposed by the thickness of the metal at the ends) was 287.177 square inches. The quantity of water contained in it was 132.534 cubic inches, and the equivalent to be added to this for the specific heat of the pipe was 39.341 cubic inches, making the estimated quantity of water 171 875 cubic inches." The temperature of the room in which the observations were conducted was 67' Fah.

This pipe was presumably used on its side in the horizontal position (though this is not stated), and represented no doubt a section of an ordinary 3-inch cast-iron heating pipe used at that time for green-house heating, etc.

He informs us the rates of cooling were tried with different states of the surface: First, when in the usual state of cast-iron pipes covered with protoxide of iron (fine rust); second, black varnished; and third, with the varnish removed and two costs of white lead paint substituted. He observed that the rusty surface cooled from 152° to 150° Fah., or 2 degrees, in 2 5 minutes, and that it cooled from 152° to 140° Fah., or 12 degrees, in 15 minutes. This is at the rate of the whole quantity of water or its equivalent cooling one degree in 1.25 minutes.

He took observations every two degrees fall of the thermometer, which give slightly varying results as to the rate of cooling, but this may be due to errors in reading the scales or in errors in the thermometer, and a close study of the table of his experiments go to confirm the belief that for all practical purposes the rate of cooling is directly as the difference of temperature between pipe or plate surface and the surrounding air.

With the black surface of the pipe black varnished he found that to cool from 152° to 150° Fah. (2 degrees) it took 2 266 minutes, and that to cool from 152° to 140° Fah. (12 degrees) it took 14.533 minutes; or, in other words, cooled an average of one degree in 1.21 minutes, showing an apparent increase of cooling as the difference between surface and air became less. If we take the average of six experiments (1.2: minutes) progressing by two degrees and correct the time observed on cooling the first two degrees by it, we have 2.42 minutes instead of 2.266 minutes. This shows that the black-varnished surface is slightly more efficient than the rusty one-a little over three per cent.*

With the pipe with two coats of white-lead paint, the efficiency was less than with either of the others, but not as great as usually considered.

The cylinder cooled from 152° to 150° Fah. (2 degrees) in (observed time) 2.316 minutes, and it cooled to 140° Fah., or 12 degrees in 15.366 minutes; or, in other words, it cooled I degree in 1.28 minutes average

Mr. Hood's summary of the matter is that 100 feet of varnished pipe, 1031/4 feet of plain pipe, and 1053/4 feet of white painted pipe have the same values as heating surface. He does not, however, give as the values of these surfaces in heat-units per square foot per degree difference no more than Mr. Tredgold does, and as this will be very important to us hereafter when we desire to

ascertain the quantity of water that must pass through a heater in a given time, to maintain some constant temperature, we will have to calculate it for ourselves by the same method of reasoning, etc., as we did in the case of the latter's experiments.

The surface of the experimental piece of pipe is given as 287.177 square inches, which is two square teet lacking less than one square inch, and therefore we will call it two square feet. The quantity of water actually contained in it was 132.534 cubic inches, and the equivalent in cubic inches of water that was to be added for the specific heat of the iron of the pipe, 39.341 cubic inches; making the estimated value of the water and its envelope equal to 171.875 inches of water.

This water was cooled from 152° to 140° Fah. in each experiment, and therefore had a mean temperature of 146° Fah. The weight of a cubic inch of water at this temperature is 248 grains; therefore we have

$$\frac{171.875 \text{ cub. in.} \times 248 \text{ grs.}}{7,000 \text{ grs.} (1 \text{ lb.})} = 6.089 \text{ lbs. of water.}$$

This water was cooled 12 degrees in the various times, which gives us 6.089 × 12 - 73.068 heat-units as the total heat given off in each case from two square feet of heating surface, or 36.534 heat-units per square foot.

The air of the room was 67° Fah.; consequently the difference of temperature, or, in other words, the excess of temperature of the surface over the air, was 89 degrees. The time for cooling the rusty cylinder was 15 minutes, for one quarter of an hour; therefore we have:

$$\frac{36.534 \times 4}{89^{\circ} \text{ Fah.}}$$
 — 1.642 heat-units

per square foot per hour per degree difference. For the varnished surface it is 1.589 heat-units, and for the white painted surface 1.552 heat-units.

COOLING EFFECT OF WINDOWS.

To ascertain the effect of glass windows to cool the air of a room Mr Hood made experiments with a glass vessel as nearly as possible of the same thickness as ordinary window-glass. The temperature of the room was 65 Fah., and the surface of the vessel was 31,206 square inches, and it contained 9.794 cubic inches of water, including the equivalent for the specific heat of glass. He does not tell us the form of the vessel, which would be very important to know, but presumably it was flat, or at least had perpendicular sides, and being small, represented an average effect in cooling. so that the deductions obtained are presumably fully equal to average conditions.

The average rate of cooling from 150° to 110° Fah. was found to be 1.176 degrees when the mean excess of temperature of surface was 65° Fah. above the temperature of the air, and the time 34 minutes.

The total quantity of water, or its equivalent, is found to weigh .3484 lb. at a temperature of 130° (its mean temperature). This cooled 40° Fah. = 13.93 heat-units for 34.296 square inches, or 58.48 heat-units for a square foot for 34 minutes, or 103.2 heat-units for an hour; /civided by the mean difference in temperature $=\frac{103.2}{6\pi^{\circ}}$

1.59 heat-units per square foot per hour per degree difference of temperature.

Mr. Hood's deductions from his experiment is to the effect, that each square foot of window-glass will cool in a minute of time 1.279 cubic feet of air as many degrees as the inside air is warmer than the external in a comparatively still atmosphere, but that when windows are exposed to the action of winds further experiments are necessary.

It is evident the cooling of air through glass, etc., depends on both the velocity of the air inside and outside taken together.

Nearly all the heat that is lost by air of rooms to cooler air through glass is lost by convection. The air inside the glass falls by loss of heat and increase of weight and follows the laws of a falling body. The velocity of air outside is due to wind-pressure and the angle at which it strikes the glass. Quadrupling the velocity of the outer air, however, does not quadruple the loss of heat through the glass, for the reason that the air inside will not fall in the same ratio but in a ratio about as the square root of the increase of outside velocity, so that the loss of heat through glass cannot be accurately established for a given difference of temperature and a certain velocity of the wind outside; an approximation, however, can be made to the loss of heat for other velocities and temperatures. Unfortunately, we have no very accurate data on the cooling effect of windows for the guidance of heating-engineers, though on the

warming effect of radiator surfaces there is not such a scarcity of information.

As these articles are on warming by hot water. I would like to be able to give some data on the values of hot-water surfaces used in common practice. Presumably, on account of the difficulty of measuring the loss of heat from hotwater coils, etc., maintained at some nearly constant temperature as in actual use, few attempts have been made and none made public except some of the writer's, and these were with indirect coils that do not properly represent the value of direct radiation. I hope, before the present winter is out, however, to be able to give some data on this question, and for the present will give an experiment with a common box-coil that approaches more nearly the condition of a radiator set for direct radiation than any thing

While making experiment on indirect coils I boxed one at the sides and ends and left the top and bottom open, so the air ascended vertically. Presumably, slightly better results would be obtained if the heater was open at the sides as well as top and bottom, but of this there is some doubt.

The coil was of one-inch pipe, 6 pipes wide, 10 pipes high, and 36 inches long between bends: the total surface of pipes, bends, and headers being 74 square feet. A difference of about 110 degrees was maintained between the air of the room and surface of the pipes during the time of trial. By measuring the increase of temperature of the air and its quantity, etc., after passing the coil the amount of heat found corresponded to 1.343 heat-units per square foot of surface per hour given off for each one degree Fah. the air was warmer than the coil. The coilbox was then closed in at the top until the outlet for air was 12x16 inches, without apparently diminishing the flow of air, the better to use the anemometer, and the result obtained was practically the same. This agrees quite nearly with the results of Mr. Hood as given for the 3-inch horizontal pipe; though on account of there being 10 pipes, one above the other, in the box-coil, it would appear that it should do less work It may be that the currents of air were accelerated sufficient by the boxing to account for the similarity. Or, it may be, an error existed in the use of the anemometer and that it recorded more air than actually passed, which is possible by taking the centre of the current; the rubbing sides of the box and pipe causing a slower velocity there than was measured where the anemometer could be used. It is not safe, however, to give a box-coil 10 pipes high, used for direct radiation, a higher value than 1.343, and presumably 1.25 heat-units is high enough.

Mr. George H. Barrus, of Boston, in experiments with a Walworth vertical wrought-iron pipe radiator for steam. found that under average conditions of use, with 8 pounds of steam, in an atmosphere of about 51° Fah, that the units of heat given off per actual square foot of surface was 394.4. If we assume the surface of the iron to be 235° Fah.—the temperature of the steam—we have 235° - 51°

- 184° difference. Then $\frac{394.4}{184°}$ = 2.143 H. U. This is considerably less than Mr. Tredgold's experi-

ments give for a short vertical cylinder, but it is what would be expected, as the pipes used were thirty inches long, and in a cluster two inches wide, screwed into a

He also experimented with a Nason radiator of ordinary height, two pipes wide by 24 pipes long. The total number of heat-units per square foot of surface given off was 347.6; the pressure of the steam was 8 pounds, and the temperature of the air of the room 64° Fah. Assuming the temperature of the pipe to surface to be 235° Fah., the difference then between air and heating surface is 170° Fah., which gives us 347.6 H. U. -2.045 heat-

units per hour per square foot per degree difference.

Mr. Barrus' method of measuring the heat was 10 receive the water of condensation carefully and to ascertain its weight, then compute the heat according to the latent heat of steam. The nearness of the results thus obtained by vertical radiators of different makes, and at different times in different buildings, by the same methods, adds value to the data and establishes the fact, when taken with other investigations, that a tube of a vertical radiator will give off heat equalto about two heat-units per square foot per hour per degree difference.

An experiment made by the writer in 1884 on a 2x7 Bundy steam-radiator, for his own information, and before the Bundy patterns were altered to have an actual surface equal to their commercial rating, gave the following

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^{*}In comparing these statements with Mr. Hood's table, note that the time here is given in minutes and decimals of a minute, while in the table it is given in minutes and seconds.

results · Actual surface, 38 square feet; water condensed for one hour was 12.843 pounds; when the pressure of steam was maintained between I and 11/2 pounds, temperature of air of room at floor commencement of experiment 52°; at 5 feet high on side wall 58°; temperature of air of room at floor at end of experiment 571/2°; and at 5 feet high 64°. The temperature of the air as it was found at the floor was presumably the temperature at which it first came in contact with the heater, but, as in the other cases, the temperature of the room only was noted-without informing us further-we will in this case take the mean of the temperature given, which is 57.9° Fah., and presumably near enough for our purpose, which is not to compare the heaters, but to establish the condensation or cooling for ordinary condition of use.

Taking the temperature of the steam (1 lb.), therefore, at 215° Fah., and the latent heat of its vaporization at 962 heat-units per pound, we will have : difference of temperature between steam (or pipe), 157.1° Fah., and total heat of 12.843 pounds of steam, 12355 heat-units, or 325.1, heat-units per actual square foot of surface, equaling 2.07 heat-units per square foot of surface per hour per degree of difference between steam and air.

It is possible that should these radiators be transposed as to the buildings they were tested in, the results would slightly differ, as the effect of the passage of heat by radiation alone from or to the radiator cannot be estimated, as it will depend on the surrounding walls, etc. For instance, one experiment being made in a cellar and enother on an upper floor of a building it is reasonand another on an upper floor of a building, it is reasonable to assume it will effect the results, and the question of humidity may also come in as a factor for or against a radiator.

(TO BE CONTINUED.)

PLUMBING LAW EXPERIENCE AT WEST NEWTON, MASS.

CITY ENGINEER ALFRED F. NOYES makes the "follow ing comments based upon his experience under the new plumbing law of that city.

The City Engineer being the agent of the Board of Health for the inspection of plumbing, his assistants were detailed as inspectors.

"The past year's experience has demonstrated that the more time they have been able to give to conversation with plumbers and owners in explanation of the rules, the more ready has been the compliance with the requests of the board. It has also been demonstrated that in order to get the best results, and more perfect work, every step in its execution should be more closely watched

in its execution should be more closely watc'ed.

"As sta'ed in my last report, the board, through the City Council, petitioned the General Court for authority to require all plumbers doing work in this city to be licensed, and March 20, 1886, the General Court passed chapter 100 of the Acts of 1886 granting the desired authority. An ordinance has been drafted in accordance with this act and is now under consideration by the board. That the ordinance is needed is shown by the large amount of careless work found to have been done, in one case the careless work found to have been done, in one case the careless work found to have been done, in one case the entire plumbing for a bath-room having been done personally by a tenant who was not a plumber. Such an ordinance will not only place the plumbers directly in contact with the board, but will also relieve the plumbers of the pressure to which they are frequently subjected by the results are interimperant of their own realizes or owners that are either ignorant of their own welfare or

desirous of saving expense.

"The inspection of new work this year has shown that more care is needed in several particulars. There is a tendency to leave the top end of the soil-pipe near windows in the roof or other parts of the house so that odors rising through the pipes are blown into the house. In some houses small S-traps are used for bath tubs, bowls, sinks, or wash-tubs. These traps are the same size as the waste-pipes, and as soon as they collect any grease the diameter begins to diminish, the sectional area of the trap becomes less than that of the waste pipe, and the trap becomes especially sensitive to either suction or force. In the case of one of these traps attached to a bowl on the second floor it was found that the wind blowing across the top of the soil-pipe suphoned the trap and allowed the the top of the soil-pipe syphoned the trap and allowed the odor from the soil-pipe to escape into the room. As the bowl was in a sleeping-room, and within three feet of the head of the bed, the danger is apparent to any one. In another case a trap of this kind was found attached to a nother case a trap of this kind was found attached to a nother case a trap being only three. kitchen sink, the diameter of the trap being only threequarters of an inch.

quarters of an incn.

"In the cheaper grade of houses, where the only fixture is a sink, it has been quite common in the past to use either a lead S-trap or to place a large six-inch earthen trap outside of the house in the main drain. During the trap outside of the house in the main drain. During the past year an endeavor has been made to improve this plan. The small S-trap is entirely unfitted for a kitchen sink on account of the large amount of grease which has to pass through it; the large earthen trap is so much larger than the waste-pipe from the sink that it is liable to stoppage not only by the collection of grease, but by reason of the insufficient scouring it gets. This trap is usually beried up in such a way that it cannot be readily opened and cleaned. The trap recommended is the lead drum or round trap; under all ordinary circumstances this trap is practically antisyphoning. It it generally set upon the floor under the sink, has a brass screw-cover, can be readily opened and

the grease removed as often as may be necessary. It has also been common in the cheaper grade of houses to construct a wash-vault, so called. By this arrangement a vault is built having a pipe leading out from the bottom to a cesspool: the waste-pipe fram the kitchen sink runs into the vault, and is supposed to wash out all the deposit It is a primitive water-closet, but the flow of water from the sink rarely comes while the deposit is in a condition to be readily removed: the force of the water is rarely sufficient, and the general result is a combination of sink-water and fæcal matter, which is much more offensive than either alone. The dry vault, well cared for, and into which sink-water is not allowed to enter, is much less offensive and is no more expensive.
"More care should be used in running vent-pipes from

traps. These pipes should be so arranged as to have a constant upward direction. In connecting traps with the main vent-pipe, it has been necessary in some cases to un the vent-pipe up and then down into the main vent run the vent-pipe up and then down into the main vent, in order to avoid cutting partitions, beams, or floors: it can readily be seen that although this arrangement may not destroy the ventilation entirely, yet it is a defect, and the downward turn prevents the perfect action of the pipe. In all cases of this kind care must be used to prevent any sags which may become traps by reason of condensation sags which may become traps by reason of condensation or other causes. All vent and soil p pes should be run as near as possible to warm chimneys or the inside walls of the house in order to secure, by reason of the warmth of the pipes, a constant upward tendency of the air within the pipes, a constant upward tendency of the air within them. When gas or screw pipe is used for ventilation-pipes, extra care should be taken that all joints are made tight. Where branches or vent-pipes are left for future fixtures, care must be taken to see that the ends are properly plugged. In one case this year a 2-inch vent-pipe was left open at the head of the cellar stairs in a position from which the gas could readily escape into all parts of the house.

During the year numerous examinations have been made of private houses at the request of either the owner or the tenant. Owing to the prevailing method of running all pipes inside of partitions or beneath floors which are securely nailed down, it is often quite difficult, and sometimes impossible, to make satisfactory examinations. sometimes impossible, to make satisfactory examinations.

Ali pipes should be run in positions where they can be readily exposed to view, and in no case enclosed in plastered partitions. This suggestion I consider of value not only from the sanitary point of view, but also on account of the economy in making repairs. All spaces enclosing soil, waste or vent pipes should be ventilated.

The principal source of trouble in old houses has arisen the continued use of the pan water closests which he

from the continued use of the pan water-closets which be-come foul in the receiver and defy cleaning except by taking them entirely apart. This style of closet is being largely replaced by the various patterns of hopper closets, which are usually provided with a copious flush of water and can be readily kept clean. A source of bad odor is the lint and dust which collects under a water-closet back of the front board. In pan closets there is often a leakage of the valves, and in hopper closets a slight condensation which runs down on the floor and keeps this lint and dust damp, and finally produces a bad odor. If water-closets were finished without front boards this defect would not occur, and any leakage would be immediately discovered. In the old style of water-closets the urine shield is often of wood or lead the wood becomes saturated and the lead is seldom washed so that the action of the urine upon either the wood or the lead is extremely offensive; enameled iron shields are now generally used, and they are not open to the above objections. The crockery and the shield of every watercloset should be frequently washed, and should be at all times kept clean and sweet. Water-closets do not always have sufficient scour of water when used to properly clean them or to remove all deposit.

It was formerly customary to run the waste-pipe from the bath-tub and bowl in the bath-room directly into the trap of the water-closet without any trap for these fixtures except that of the water closet. The result is a liability of fæcal matter to stop up the waste-pipes, and bad odors frequently arise from them. In some instances the waste-pipes have become so stopped from this cause, that water pipes have become so stopped from this cause, that water discharged from the bowl backs up into the bath-tub and then slowly runs off from there. In one case noticed the bath-tub was pitched the wrong way, and when the water from the bowl backed into the tub about one-half inch of dirty water remained at the head of the tub and could not run off. In some cases bath-rooms or water-closets are placed in rooms without windows. They should never be been the property of suplicit and air

placed in rooms without windows. They should never be placed where they cannot have plenty of sunlight and air. "In one building the exhaust-pipe from a steam-engine in the basement was connected with a soil-pipe which did not extend through the roof, the result being that the steam forced every trap in the tenements above, and frequently puffed out in the rooms. In one house that was repaired it was found that there had never been a trap on any fixture in the house and one of the bath rooms in the

any fixture in the house, and one of the bath rooms in the house opened directly into a sleeping apartment.

'After inspecting one residence the following report was sent to the tenant: 'Hopper closet in cellar with was sent to the tenant: Propper close in Cenar with direct supply from the city main, very poor flush or scour; wash tubs in cellar have drum-trap apparently all right; bowl on first floor not known whether trapped or not; kitchen sink on first floor in same condition; waste-pipe from bowl on second floor deposits contents in bath-tub; waste from both tub very slow, apparently stopped; no trap appears upon either bowl or bath-tub; pan water-closet sends out very strong stench when pan is dropped; the crockery and lead urine shield on this closet were extremely dirty, and should be washed; general smell of

bath-room very foul and recommend that windows be kept open; soil-pipe stops at second floor, has no foot-vent, and joints are apparently made of putty; same tank used to supply water-closet on second floor that is used for believing history. boiler in kitchen.

The foregoing cases are samples that are frequently met by the inspectors, and show the necesity which has existed for the rigid enforcement of the rules ordered by I am pleased to say that I think both owners and plumbers are appreciating more and more the necessity of more care in designing sanitary appliances, and that the standard of work has been raised very much during the nest year." ing the past year.'

MASTER PLUMBERS' ASSOCIATION OF BOSTON AND VICINITY.

AT a meeting of the Master Plumbers' Association of Boston, held December 22, the following officers were elected for the ensuing year: President, John H. Stevens; First Vice-President, Isaac Riley; Second Vice-President, Daniel G. Fin: erty; Third Vice-President, Thomas J. Tute; Treasurer, John Crawford; Recording Secretary, William H. Mitchell; Financial Secretary, John W. Cosden; Corresponding Secretary, Frank A. Titus.

THE NEW YORK HEALTH DEPARTMENT SECURING THE PUNISHMENT OF "SKIN" PLUMBERS.

IT affords us pleasure to commend the New York Health Department for its endeavor to secure the punishment of 'skin' builders and plumbers who persistently violate the law. Below we give a list taken from the files of the Health Department a couple of weeks ago of recent arrests and convictions:

William M. Kearney was arrested for defective work at 506 West Forty-fourth Street. Inspector W. E. Partridge reported many open and defective joints in soil and waste pipes, especially in water-closet connections and traps. There were free openings in the soil-pipe at many joints, and in one case the spigot end of a length of pipe did not engage at all with the hub of the next end. Mr. Kearney was fined \$250.

John Kear was arrested November 2 for defective plumbing in two tenement-houses on corner of Tenth Avenue and Fortieth Street, reported by Inspector Partridge. The numerous open joints found in soil-pipes were varied with some joints stuffed with oakum and no lead. Mr. Kear upheld the merit of his work and insisted to Chief Inspector Collins that there was no better in New York City. However, he deemed it expedient to plead guilty to the indictment for violation of the health laws, and, in consideration of the most thorough reconstruction of the work in question, his conviction only cost him a fine of \$50, since the payment of which his recent work has endured the most severe tests and inspection.

John McNamarra, 248 East One Hundred and Fourteenth Street, was arrested November 5 and fined \$100 for plumbing violations in five tenement-houses on One Hundred and Fourteenth Street, east of Madison Avenue. Inspector W. H. Titus found cracked pipes, defective joints, open joints, joints packed with paper instead of oakum, and one instance where mud was used for calking a joint in a fresh-air pipe. Out of a total of 19 joints 14 were calked with paper and one with mud.

James G. Collins was arrested October 5, convicted, and fined \$100 for generally defective work in four houses on Ninety-fifth Street, east of Ninth Avenue, reported by Inspector L. M. Hooper. Sample joints were made by layers, first of oakum, then mortar, and a thin film of lead on top. This work was especially defective where least accessible, on the evident assumption that it could not or would not be inspected in such places.

Christopher Nally, 255 East Forty-ninth Street, was arrested November 19 for defective plumbing in tenement 319 West Forty-fourth Street, where Inspector Partridge found almost innumerable defective joints.

Mr. Nally was tried by Special Sessions December 15, and, although vigorously defended by two lawyers, was convicted and fined \$150.

Ellis & White, 141 East Fifty-ninth Street, were arrested for defective plumbing in four houses at northeast corner of Tenth Avenue and Ninety-third Street, where Inspector H. D. Dickinson found many open joints, nearly all filled with putty to deceive the inspector. They were convicted at the Court of Special Sessions, December 14, and fined \$250 each.

Thomas White, of the above firm, was convicted at the same time on a separate charge of violation of plumbing laws in five houses on north side of Eightieth Street, west of Lexington Avenue.



Inspector J. T. Corcoran found open joints in housedrain and soil-pipe, also split pipe, waste-pipe graded the wrong way, and other violations, for which Mr. White was fined \$250 more.

Both of the last two cases were vigorously defended and occupied one entire day in trial.

F. M. Clemmens was arrested November 7 for "skin" work at 9 East Eighty-fifth Street. Inspector Hooper reported a large number of open and defective joints.

Thomas Flynn, 101 West Sixtieth Street, was arrested November 10 for plumbing violations reported by Inspector Dickinson in Nos. 115 to 151 Ninety-seventh Street. Numerous defective joints and cracked and split pipes were found throughout the different buildings discharging sewer-gas into the apartments.

James G. Collins, who was arrested October 5, and convcted for "skin" plumbing, has since been rearrested for defective plumbing in six houses on north side of Ninetyfourth Street, west of Eighth Avenue. Inspector Dickinson found defective joints, split pipes, open joints, and joints containing no packing whatever-not a trace of either oakum or lead. Some of these pipes were very difficult of access, showing a disposition to do bad work where an inspector could not examine it or would be greatly inconvenienced in penetrating. It chanced that one of the above houses was owned by a prominent physician, who was much astonished and chagrined at these developments, and equally grateful for the efficient investigation and action taken by the Health Department.

John Kelly was arrested for "skin" plumbing in twelve tenement-houses on west side of Eighth Avenue, between One Hundred and Forty-seventh and One Hundred and Forty-eighth Streets. The work was wretchedly done throughout, the examination by Inspector Hooper disclosing 125 open joints; also joints otherwise defective, split hubs, cracked pipes, joints partly calked and others not calked at all. In some instances the house-drain had no fall, and in others it was in the wrong direction, being graded towards the house instead of sewer. Upon his hearing before the Police Justice, Mr. Kelly loudly demanded "trial by jury," which he insisted should be composed of mechanics. This elicited the suggestion that it might appropriately and satisfactorily (to him) be further restricted to contain only "skin plumbers."

THE USE OF KEROSENE OIL IN STEAM-BOILERS.*

BY LEWIS F. LYNE, JERSEY CITY, N. J., M. A.M. SOC. M.E.

THE action of kerosene oil for the prevention of scale in steam boilers is a subject upon which the books appear to be silent. At least the writer has been unable to find to be silent. At least the writer has been unable to hid any practical data, that could be made use of, in determining its value as a scale-destroyer. It has often been recommended, but its application for that purpose, so far, has been quite limited. Many theories in regard to its action inside of steam-boilers, have been indulged by engineers, but no systematic course of treatment has yet been brought to my notice. Therefore, a portion of practical experience is presented herewith, in that line, with the hope that others may be induced to compare notes,

the hope that others may be induced to compare notes, and all parties concerned receive substantial benefit. In consultation with an engineer, for whom I entertain a very high regard, he suggested that I try crude petroleum as it was better than kerosene, but he gave no plausible reason why, nor advice as to the quantity or method of introducing it. There was but one course left for me to pursue, which was to try some experiments.

At the Jersey City Electric Light Company's station we have two sectional boilers of the new Root type, 100 horse-power each, and one of 155 horse power. We use the Passaic water, which makes a great deal of scale, and in the steam space, I have noticed a very marked corrosive action, more especially upon the cast-iron flanges of the safety-valves. Within the shell-boilers, which we formerly used, hard scale was formed to an alarming the safety-valves. Within the shell-boilers, which we formerly used, hard scale was formed to an alarming extent, and we could not get a scraper between the tubes to remove all of it. In the dry season salt water found its way into the reservoir, and I now have large lumps of saline matter which were removed from our boilers.

In the boilers which we are now using hard scale would form so as to more than half fill some of the 4-inch tubes of which our boilers are principally composed. Something had to be done. I had tried several compounds, with more or less degrees of success, but still the interior of our boilers could not be kept clean. We tried blowing off, used scrapers and other devices, but without obtaining permanent relief. The deposit was mostly in the lower row of tubes, and within four feet of the back ends near the mud-drum. . The loss of heat due to this incrustation

Nystrom gives the following for calculating this loss:

 $H = \frac{1}{32 \times t^3}$

In which t equals the thickness of scale in sixteenths of

an inch, and H the per cent. From this it would seem that a scale of one sixteenth would cause a loss of about 15 per cent.; three sixteenths, 23 per cent., and so on. Some have claimed the conductivity of scale to be at least 30 per cent. less than iron, hence we recognize the necessity of keeping boilers free from scale and sediment

30 per cent. less than iron, hence we recognize the necessity of keeping boilers free from scale and sediment.

As a preliminary experiment with kerosene oil, I took a test-tube of 1-inch diameter, and in it placed a lump of scale taken from our boilers. A tablespoonful of water was then added, with a film of kerosene upon its surface. Heat was then applied from a Bunsen burner. When ebullition began, the kerosene separated into globules and followed the sides of the tube to the bottom, thence they arose through the centre to the surface. This action continued as long as heat was applied, and proved conclusively, to my mind, that the kerosene would not remain upon the surface of water in a boiler, as has been argued by some engineers. I have since proved this correct, beyond a doubt, by drawing water impregnated with kerosene from near the bottom of the boiler. From the time the water in the test-tube began to simmer the scale commenced to disintegrate, and continued until nothing was left but the hardest substances.

I concluded from this experiment that kerosene oil was just the thing to use in our boilers, so an apparatus to introduce it was made, and attached to the feedpipe. It is an inexpensive affair, made of a piece of five-inch iron pipe, twelve inches long, with a cap screwed upon each end as shown. A pipe at the bottom connected with the hydrant, while the pipe at the top conveyed the kerosene into the teed pipe when the water was turned on. A tallow cock was screwed into the top for filling while the air and water were drawn off at the stop-cocks shown for that purpose. When the feed-water is taken from a tank, or well, where there is no pressure to force it into the boiler, a globe-valve must be placed in the feed-pipe, so as to compel the water to flow temporarily through the reservoir, in the direction shown temporarily through the reservoir, in the direction shown by the arrows, carrying the oil along with it. Our feedpipes used to clog up with hard lumps of scale and rust from the water, but since we began using kerosene, these pipes are all clean and they do not rust. I therefore recommend that the reservoir be placed so that the kerosene may pass through all the water-pipes if possible. When our apparatus was ready for use the water was blown off from a 100 horse-power boiler, the blow-cock closed, and two quarts of kerosene oil introduced. The injector was then started (by steam from one of the other boilers), and as the water rose, the kerosene reached every part of the interior surface. Before filling this boiler an examina-tion was made which showed scale in the tubes of threesixteenths to one-quarter inch in thickness, while in the headers it was half an inch thick in places. We never put cold water in our bo lers, either to wash or fill them, put cold water in our bo lers, either to wash or fill them, unless they are cold, for I have known cracks to originate in steel boilers by so doing. We put in two quarts of kerosene every other day for one month, when this boiler was blown off at ten pounds pressure. It was then opened and examined when we found that the scale was partly dissolved and loosened so that a scraper removed most of it from the inside of the tubes. The scale in the headers remained quite hard, although the surface was softened by the action of the kerosene. The blox-off cock was then closed, and two quarts of kerosene put in, after which the boiler was filled with water, as described. The object of putting in the kerosene first is to have it penetrate the of putting in the kerosene first is to have it penetrate the or putting in the kerosene first is to have it penetrate the scale and loosen it as the water rises, and we know that it does this. During this second month we used the same quantity of kerosene, and in the same way as the first month. At the expiration of that time the water was blown off, and an examination revealed the tubes perfectly clean there was, however, some scale left in the headers, but it was so soft that it could be easily removed with the finger nails. We used no scraper this time, but just closed it up, put in two quarts of kerosene and filled it as at first. During the third month we blew down two gauges of water every week and used the same quantity of kerosene At the expiration of the third month we blew as before. off the water and opened the boiler when to our satisfaction we found it *clean*, a condition that never before existed since we started the boilers. The dirt had all settled in the mud-drum and when the blow-off cock was opened it passed into the sewer. Not a teaspoonful of sediment was found inside this boiler. I closed this boiler and ran it taree consecutive months without opening the blow-off cock or changing the water during that time, using the same quantity of oil as before. At the end of the three months the water was blown off and no dirt was found in the tubes, and very little soft mud in the mud-drum. This I thought was a very conclusive experiment. We then adopted a rule of one quart of kerosene per day for each of the 100 horse-power boilers, and three pints for the 155 horse-power boiler. The water is blown down two gauges every week and the entire contents every month. Water is never used to wash them out nor is a scraper necessary; for the mud all goes out with the water. An examination is made of the interior and we put them to work again. This is a wonderful relief to us, for the reason that no scale forms in any of our boilers, and the corrosive action mentioned as having existed at first has entirely ceased.

Another thing worthy of special notice is, that it was within two months. Before using kerosene these tubes would become badly grooved and eaten away at the upper ends so that they would break. Our engineer came very near losing his eyesight through the breaking of one of

these glasses, and his face was badly disfigured by being cut with the broken glass. Now these tubes do not show any such action, and they have been in use more than a

I admit that rubber packing and kerosene oil do not 4 agree, so to guard against any trouble from that source, I had new nuts 1½ inches deep placed at the ends of the glass tubes, and used asbestos wicking dipped in boiled oil, and then squeezed dry, for packing. They do not leak and these joints are permanent.

use rubber packing in flange-joints about a boiler, or in any place where it comes in contact with steam. For faced-joints, I insert asbestos in sheets, one sixteenth inch in thickness; and for rough joints, the sixteenth inch in thickness; and for rough joints, the same material one-eighth inch thick. After purchasing the asbestos, I spread upon both sides, with a brush, all the boiled oil that it will readily absorb, and then hang up the sheets until required for use. When a gasket is needed, we cut it to the required size, then rub both sides well with pure graphite, and screw it up hot, after which no more attention is required. We have joints made in this way which have been in use more than there were this way which have been in use more than three years, and as yet have showed no signs of leaking. I took some of them apart recently, and the surfaces separated very nicely, and there was no evidence of rusting or corrosive action upon them. A short time since, one of our neighaction upon them. A short time since, one of our neighbors had great difficulty in making a joint upon a badly rusted mud drum of a shell boiler, and it could not be kept tight for any considerable length of time. He made a gasket of asbestos prepared as described, and has not a gasket of asbestos prepared as described, and has not touched it since. In taking apart our flanged joints, we broke no bolts nor split any nut, as is usual with such joints made in the ordinary way; for, when these joints were made, we smeared the threads and nuts with graphite mixed with boiled oil. A small quantity of this substance rubbed upon the stems of safety-valves will prevent them from sticking or corroding. A small monkey-wrench easily removed the nuts, and none of them were rusted. This is the way we treat all of the nuts and bolts upon our boilers, and the same mixture is used in putting up steamboilers, and the same mixture is used in putting upsteam-pipe. The result is that we break no fittings nor do we split any pipe in taking them down, after years of service. I am aware of instances where graphite used upon iron surfaces has shown, when taken apart, a sort of hard scale, having the appearance of some sort of cement. This is liable to occur when the graphite contains foreign substances, such as silica and sulphur. The common. cheaper forms of graphite will not give satisfaction for these purposes; it must be pure. The kind that I now use, and poses; it must be pure. The kind that I now use, and have used for the past fifteen years, is made by the Dixon Crucible Co., who have a special process, by which they remove all earthy and mineral substances, leaving the flakes of graphite pure. I have never had any unpleasant experiences with this grade of graphite, and have used it experiences with this grade of graphite, and have used it extensively, not only as described above, but also in the cylinders of steam-engines. In conclusion, I desire to say that crude petroleum has, to my certain knowledge, been used in steam-boilers during the past eleven years and upwards, where, with judicious application, it has been successful in removing and preventing scale. While this is admitted, I must also acknowledge that great damited to believe her resulted by not observing the receiver. age to boilers has resulted by not observing the necessary precautions in the quantity put into the boiler each time. I will mention but one instance, which is that of a tug-boat now running in New York Harbor. The boiler was badly scaled, and some one advised the engineer to use crude petroleum; so he "gave the boiler a good dose," as he said. In a few days the tubes began to leak, and the he said. In a few days the tubes began to leak, and the crown-sheet bagged down. The boat was then laid up, when it was found that the heavy oil had mixed with the mud and had formed a paste on the crown-sheet. This paste kept the water from reaching the plates, hence the result stated above. This paste was so dense that water from a hose would not dislodge it; and I do not hesitate to say that, had kerosene oil been used in this instance instead of crude petroleum, the boiler would not have been instead of crude petroleum, the boiler would not have been injured. The reason is that there is not sufficient body in kerosene oil to form a paste. The chief objection to crude petroleum is that it is too heavy, while in kerosene oil there is no substance which will stick fast to the interior of a

In it we find all that is necessary to accomplish the desired object without the objectionable features just mentioned. I appreciate the fact that there may be instances where steam is blown directly into fibrous materials in the course of their manufacture, and also in the preparation of articles of food, where the odor or possibly the taste of kerosene oil might be disagreeable; but such instances are few, when compared with the many, where it might be successfully employed for the prevention of scale in steam-boilers. Some engineers advance very queer theories against the use of kerosene; but I must assert that, for the most part, they are only imaginary. We have as yet found no objections in our experience. Our boilers do not lift their water, they are free from scale, and our fuel bill is thereby greatly reduced.

THE NEW BRIDGE AT CAIRO.

THE new Cairo bridge across the Ohio River is to have two spans 518 feet each, seven 400 feet each, and three 250 feet each; total length, 4,760 feet. It will be 53 feet above high-water mark, and will cost \$2,500,000. It will take 21/2 years to build it.



Abstract of pap r read at the sixteenth annual meeting of the American Society of Mechanical Engineers.

Correspondence.

All correspondents should s-nd us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

"THE OLDEST TIMBER BRIDGE OF ANY CON-SIDERABLE SPAN."

WINFIELD, KAN., December 22, 1887.

WINFIELD, KAN., December 22, 1887.

SIR: I had intended some time since to call your attention, as a matter of historical interest in the progress of bridge-building in America, to the claim of Professor Trowbridge in his article in No. 20, Vol. XVI. (October 15), for the Towne lattice bridge therein referred to as "probably the oldest timber bridge of any considerable span in this or any other country." If the bridge he refers to is still standing the claim may now be good, but two years ago, a bridge then standing in Chillicothe, Ohio, would have been entitled to priority, having been built and opened for travel in 1817 and in continuous use until torn down to be replaced by an iron superstructure. torn down to be replaced by an iron superstructure.

The bridge I refer to was built of oak timber and cov-

ered, and consisted of two spans, each 150 feet in length, with double roadway. The trusses were laminated arches, slightly braced, from which the roadway was suspended by wrought iron rods.

The old masonry piers were in good condition, and after

being pointed up and slightly repaired, received the new superstructure.

Last year I prepared a description of it, which will be found in the "Proceedings of the Ohio Society of Surveyors and Engineers."

Respectfully yours,

CHARLES B. COOK.

ON ARRANGEMENT OF VENT-PIPES FROM A WATER-CLOSET.

BIRMINGHAM, ALA., December 20, 1887.

BIRMINGHAM, ALA., December 20, 1887.

SIR: As I am now fitting up Mayor Lane's new residence, I would like your opinion on the arrangement of my vent-pipe from two of his water closets. I enclose sketch. My soil-pipe is 4-inch, using Y and ½ bends in making all connections and offsets in soil and vents until I get above floor, where I used full-size lead, 2-inch for trap-vents into soil-pipe vent, 1½-inch for other two vents, the receiver, and bowl. All vents run separately to deck on roof. There is no other work over his. The traps, eight pound, with seat, and 4-inch brass ferrule wiped on the lower end of receiver. The vents rom bowl are run to outside wall for current.

Respectfully, W. H. FRANKLIN.

THESE PIPES TO CONVENIENT POINT OUT OF DOORS . GAS JET VENT FROM UNDER SEAT METHOD OF RUNNING VENT PIPES FROM THIS TYPE OF W.C

The vents, which we have labeled A. B. and C. are each for a different purpose. A is the trap-vent to prevent syphonage. Under the conditions stated the size mentioned is ample to serve the purpose. B is the vent from the receiver used on this form of closet to permit the expulsion of air confined between the water in the trap and that in the bowl; to carry this to the nearest convenient point out of doors, where the occasional puff of air will cause no offense, is the proper thing to do in the latitude of Birmingham. C is the vent from under the seat or bowl intended to secure local ventilation - i. e., to ventilate the apartment in which the watercloset is placed. If this vent went directly out of doors without the aid of artificial heat inside the house the draught would often be from out doors into the room and thence into the house. To maintain a constant draught out of the water closet apartment, this pipe should have a gas-burner lit within it, and for that purpose there are several forms of lanterns made to adjust to such a ventpipe]

CAN THE ELEVATED ROADS BE OPERATED WITH LESS NOISE?

NEW YORK, December 12, 1887.

SIR: About two months ago I moved into rooms situated near one of the stations of the Sixth Avenue Elevated Railroad, not realizing what an intolerable noise the trains and locomotives make, and my experience, which must be the same as that of many others, causes me great regret at choosing the situation. The trains passtwo arriving at the same moment—with great frequency; the rumbling noise of the heavy train on the slight iron structure is very loud, and the puff, puff, puff, puff of the locomotive as the train starts out of the station is exceedingly startling and annoying. I notice that the drivers of the locomotives differ in their management of them; some cause them to puff only a few times at the very start, and not at all when the trains are light; other drivers cause the locomotive to puff a distance of 400 to 500 feet without regard to the length or weight of the train behind them. The sudden and violent puff of the steam is very trying just as one has laid down to sleep, and in my own case has an irritating effect on my nerves. I write to inquire whether it is possible for the locomotive drivers to accomplish the work required without making so much noise. I confess having no practical knowledge on the subject.

If nervous irritation and personal discomfort were the only results of these circumstances, one might perhaps get used to them, as my neighbors say I should do; but two physicians who make a specialty of the ear inform me that the continual noise to which my ears are subjected will eventually dull my hearing. As I have no predisposition whatever to deafness, the prospect of becoming so does not please me very highly. One of these aurists says he has patients whose deafness can be traced to the noise of the L roads.

The citizens of New York are long suffering and endure many evils, but is not this a new one and very serious in character? Do not imagine I am opposed to the elevated roads per se, for their importance is incontestable; the question I would raise is: Cannot they be operated with less noise?

One word more of a personal character: I have mentioned "nervous irritation," which may cause you to think me a weak, invalided woman, but, on the contrary, I am a stout, hearty man of forty and odd years, who is not commonly conscious of possessing nerves.

O, that the day may soon come when electricity will move cars on the L roads cheaper than steam! To expect the change sooner is to place too much confidence in a money-making corporation. With President Grant, I cry: "Let us have peace." KNICKERBOCKER.

[We shall comment on this later, and meantime should be glad to hear from our readers on the subject. Dwellers in New York have so hardened themselves to endure the noise of the elevated roads as an unavoidable evil that it is only when some new sufferer complains that we realize that the evil is not less great because it is chronic. There is fame and fortune for the man who can devise an efficient remedy.]

NEW YORK HEALTH BOARD PLUMBING REGULATIONS.

SIR: What is the object of a trap to an overflow-pipe of drinking-water tank, as required by section 45, recently published regulations of the New York Health Board? It is seldom likely to have water in it.

[We do not know. Possibly our health authorities will explain.]

MURIATIC ACID FOR CLEARING WATER-BACKS.

SIR: I do not know whether your readers are aware of the fact, but as I have never seen it in print, I venture to send you a recipe for removing lime from water-backs. Until recently we have used drills, but upon the suggestion of an expert chemist, whose water-back was stopped, we used muriatic acid and have continued to do so ever since, with good results. W. G. N.

MILWAUKEE, WIS.

MUNICIPAL DISPOSAL OF GARBAGE.

WILKESBARRE BOARD OF TRADE. WILKESBARRE, PA., December 21, 1887.

SIR: The question of the safe, prompt, and systematic removal of house garbage increases in importance with the growth of a city. It is beginning to attract some attention here, and I have been requested by a committee appointed to consider it to make such inquiry as I can with regard to

the plans or methods pursued in cities where the matter receives recognition at the hands the municipal government, or touching any scheme, public or private, that has had the approval of experience. I am informed that the subject is one with which the editors of THE ENGINEER-ING AND BUILDING RECORD are more likely than any others to be informed. If it could be treated generally in your columns it would answer our purpose, and, it seems to me, be appreciated by your readers in every direction. Respectfully,

C. BEN JOHNSON, Secretary.

[We shall try and review this matter in a subsequent issue. Meanwhile, should be glad to be advised of any cities that have resorted to the cremation of their garbage.]

ENGINEERS' CLUB OF KANSAS CITY.

THE first annual meeting of the Engineers' Club of Kansas City was held December 19.

There were present Messrs. W. B. Knight, W. H. Breithaupt, T. F. Wynne, J. A. L. Waddell, F. W. Tuttle, C. E. Taylor, George C. Stealey, W. Kiersted, C. G. Wade, K. Allen, and five visitors.

Nominations for officers were made as follows: For President, William B Knight, J. A. L. Waddell; Vice-President, Octave Chanute, A. J. Mason; Directors, T. F. Wynne, William B. Knight, W. Kiersted, William H. Breithaupt; Secretary, Treasurer, and Librarian, Kenneth Allen, William H. Breithaupt, it having been decided to unite the offices of secretary, treasurer, and librarian.

The President presented a subscription list for the purpose of defraying expenses of a dinner which he proposed the club should hold in the near future.

Dr. Waddell read a continuation of his "General Specifications for Highway Bridges of Iron and Steel," begun at the last regular meeting, and requested the endorsement of the club. It was voted that the President appoint three members of the club to consider the advisability of such action. Those appointed were Messrs. Chanute. Breithaupt, and Mason.

After a few remarks by Mr. Walker, of Cleveland, the club adjourned to hold its next regular meeting January 9.

NEW ENGLAND WATER-WORKS ASSOCIA-TION.

THERE will be an adjourned meeting of this Association at Young's Hotel, Boston, on Wednesday, January 11, T888

The rooms will be open for members at 11 o'clock A. M. The association will not be called together until after lunch, which will be served promptly at 1 o'clock P M. Lunch tickets, \$1.50.

Edwin Darling is President; R. C. P. Coggeshall, New Bedford, is Secretary.

BUILDING IN ST. PAUL.

(Special Correspondence.)

ST. PAUL, MINN.

The building in this city for the past year has been more extensive than in any other year since the city was incorporated. The total city and suburban building amounts to \$11,543,314. This is an increase of over \$2.000,000 from the figures for 1886. During the year, exclusive of the present December, permits have been taken out to the number of 3,953. There have been 102 buildings erected costing \$10.000 and over; one under way costing \$500,000, another \$300,000, another \$350,000. Over \$300,000 has been spent in school buildings. The total amount of money expended on minor permits was total amount of money expended on minor permits was \$3,644.173. Over \$100,000 was expended in churches; \$235.000 in railroad improvements; \$104,000 in manufacturing; \$603,000 at North St. Paul suburb; over \$1,000,000 at the stock yards, and nearly \$300,000 at St. Paul Park

PERSONAL.

FRANK BERESFORD, Asst. Eng., Cincinnati. Hamilton and Dayton Railroad, died on the 15th inst. of typhoid

LIEUTENANT JOHN BIDDLE, Corps of Engineers, U. S. A., lately stationed at St. Paul, Minn., is now on duty at West Point, N. Y.

F. N. FINNEY, C. E., Managing Director, Wisconsin Central Associated Lines, will sever his connection with this company after January 1, 1888.

COLONEL CHARLES PAGE, Med. Dept., U. S. A., has been appointed to the position of Assistant Surgeon-General, made vacant by the retirement of Dr. Perin.

EDWARD C. CABOT, President Boston Society of Architects, has lately been appointed consulting architect to the Board of Commissioners of New Suffolk County Court-House building.

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CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

UNITED SEWER-PIPE MANUFACTURERS' ASSOCIATION.

THE United Sewer-Pipe Manufacturers' Association was in session last week at the Lochiel Hotel, Harrisburg, Pa., for the purpose, mainly, of considering the question of trade discounts. It was resolved to allow the full trade discount only to firms who simply sell pipe and agree not to engage in the business of laving it. Rochester, N. Y., Philadelphia, Camden, N. J., Boston, Portland, Me., Cleveland, Akron and Toronto, O., and other cities were represented at the meeting.

ARCHITECTURAL COMPETITIONS.

DULUTH, MINN.—Plans are wanted in this city for a two-story brick and stone school-house, cost not to exceed \$20,000, until February 4. Five hundred dollars is the premium offered for the plans adopted. Address George Rupley, Clerk Board of Education.

EAST SAGINAW, MICH.—Plans are wanted in this city for an eight room school-house, to cost, estimated, \$13,\$80, according to specifications. Until January 11. Address A. D. Camp, of the Committee on Building.

MINNEAPOLIS, MINN. — Instructions to architects desiring to submit in competition plans for a public building to cost \$1.150,000, to be erected in this city, have been prepared by the Board of Court-House and City Hall Commissioners, and they will be mailed to any address upon application to the Secretary, Charles P. Preston, 221 Second Avenue South, Minneapolis.

ST. PAUL, MINN.—The trustees and officers of St. Luke's Ilospital desire preliminary sketches of a new hospital building to be of brick, fire-proof, with all modern improvements. Plans accepted to be paid for. Plans to be submitted to Mrs. Oliver Dalrymple, President. Further information can be obtained of Mrs. Dalrymple, or of the Secretary, Mrs. James Gilfillan.

MESSRS. CABOT & CHANDLER, of Boston, have lately been chosen by the Trustees of Harvard College as architects of the Hastings Dormitory.



For works for which proposals are requested see also the "Proposal Column," pages i-iv-viii-79.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and rel able news for our "Contract ng Intelligence." Information of importance sent us exclusively, and not essewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

BUFFALO.—The Common Council Sewer Committee has adopted a resolution providing that the City Engineer prepare specifications, and that a notice of intention be published, asking for bids for doing the work of ventilation of the trunk sewer according to Thomas Dark's plans.

VALDOSTA, GA.—Our correspondent writes from here: "Nothing has as yet been done toward water-works."

FRANKFORT, MICH.—Our correspondent writes concerning the project of establishing water works here, as follows: "Special election for bonding the village for \$10,000 will take place January 10."

NEWPORT, N.II —Our correspondent writes: "Routes have been surveyed from Long Pond in Croydon, and from Sunopee Lake outlet at Sunopee Harlor, distance between five and six miles each, at an estimated cost of \$50,000 to \$60,000. The Legislature of 1887 granted to Hon. Dexter Richards and Frederick W. Lewis a charter for a stock company, and the work will probably be undertaken in 1888."

WINFIELD, KAN.—Our correspondent writes: "The City Council has been considering the matter of establishing a system of sewerage for this city. Preliminary surveys have been made and a general plan prepared for the principal part of the city by the City Engineer, Charles B. Cook. The system as proposed would require some twenty-four miles of sewer, principally pipe. Final action has not yet been taken, and owing to the present depression in business, may be delayed until next season."

ALFRED CENTRE, N. Y.—Our correspondent writes: "A company has been incorporated, and stock books opened, for the purpose of putting in water-works. We anticipate commencing operations as soon as spring opens."

WEST WINSTED, CONN.—Partial surveys have been made for the improvement of the water-power here. Dams, canal, and tunnel from 2,000 to 3,000 feet long, preliminary to the work, are being constructed. Messrs. Hull & Palmer, civil engineers, of Bridgeport, Conn., have the work in charge.

NEW CANAAN, CONN.—Messrs. Hull & Palmer, civil engineers, of Bridgeport, Conn., write as follows: "Surveys and estimates have been made for water-works at this place, and plans of sewerage will soon be made."

WEEPING WATER, NEB.—An election has been called here for January 2 to decide whether or not to issue bonds in the sum of \$15,000 for water-works.

RANTOUL, ILI..—It is reported that Isiah Estep is at the head of a scheme to establish a system of water-works for this place.

MOUNT VERNON, N. Y.--The Board of Trustees have approved the plans prepared for sewering the village, and, it is said, work will soon be commenced.

BEATRICE, NEB.—About \$20,000 is to be expended on the water-works system here; 21,260 feet of additional pipe are to be laid.

ABINGTON, MASS.—The water-works system here will probably be extended by the addition of 21,000 feet of extra mains. The town will ask permission to issue \$30,000 in bonds for the improvement.

DELAWARE, O.—F. M. Marriott, attorney at law, of this city, writes as follows concerning the proposed water-works: "I have just organized a company, with a capital of \$100,000, to build water-works in this city. We have taken no steps further as yet, except to present propositions to the City Council for franchise, which, if granted on fair terms, will enable us to contract at once. We hope to be able to begin work in the early spring. The capital will be furnished at home."

ALLEGHENY, PA.—The Water Committees of the Allegheny Council met recently and determined upon going to Nine-Mile Island for water, which, if Councils consent, will be brought to the city in a steel main, five feet in diameter, costing about \$1,000,000, with a capacity of 32,000,000 gallons per day. The question now awaiting solution, and referred to Messrs. Cochrane, Swindell, and Robison for comparative estimates, is whether to put in light engines at Nine-Mile Island with sufficient force to carry the water to the City Water Works, where it will be repumped into the delivery mains, or whether to put in heavier engines to force the water 300 feet up a stand-pipe, which would give it sufficient head to distribute throughout the city, and thus abolish the present plant. It is said that the plan of building settling reservoirs at Nine-Mile Island will be abandoned. The reservoirs were estimated to cost about \$700,000, and it was suggested that it would probably be cheaper and more satisfactory to build a stand-pipe and put in a filter-system. The filter company which some time ago offered to put in their system at the water-works with a capacity of 20,000,000 gallons a day for \$300,000 has sent a communication to the committee offering to put in a plant with 30,000,000 gallons capacity at Nine-Mile Island for the same money. The committee will meet again to further consider the matter.

MONTGOMERY, ALA.—Mr. Rudolph Hering, C. E., of Chicago, Ill., has made an examination of the plans for the proposed system of sewerage for the city of Montgomery, Ala., and Captain Williamson, the City Engineer, will now proceed to finish the general plans for the work. Mr. Hering will make a written report to the City Council.

ALBANY, N. Y.—The special water commission at a recent meeting postponed the letting of the contract for furnishing pipe and other materials until January 3.

PORTERVILLE, CAL.—The place expects to obtain a water-supply from the Tulaie River and operations towards establishing a system are soon to be commenced.

AUSTIN, TEX.—The Capital Water, Light, Heat and Power Company will probably soon begin building water-works, and it is reported that they will add gas works and an electric lighting plant before long.

KANSAS CITY, Mo.—Address City Engineer Donnelly for particulars concerning several thousand dollars' worth of sewerage and street work which is to be done here, and for which he has plans prepared.

LEBANON, PA.—This city is to have a new sewerage system. For particulars address Mr. Riddle.

Welland, Can.—It is reported that waterworks, to cost \$32,000, will be erected here.

COXSACKIE, N. Y.—It is reported that a system of water-works will be established bere

CORPUS CHRISTI, TEX.—The Mayor can give information concerning a proposed system of water-works for this place.

BALTIMORE, MD.—1t is probable that the Water Board will spend \$300,000 for a high-service reservoir, and about \$60,000 in additional pumping-machinery.

WASHINGTON, O.—Water-works will probably be established here. Address F. Johnson for details.

MOUNT VERNON, ILL.—This place will expend \$25,000 on a water-works system, and steps are now being taken toward establishing the same. For particulars address Mayor George H. Varnell.

MINNEAPOLIS.—Bids opened for furnishing 2,000,000 brick for sewer-work in 1888. William B. Griswold offered to furnish the entire lot for \$11 per 1,000; C. J. Swanson, \$12. Decided to readvertise.

MINNEAPOLIS.—Bids for the new pumpingstation are to be advertised for, to be opened January 10.

BRIDGES.

HUNTINGBURG, IND.—Our correspondent writes. "We have decided to put a 100 foot span iron bridge, twelve feet wide, across Mill

GRAND FORKS, DAK.—In reference to bridge matters here our correspondent writes. "We have expended \$7,500 the past year in building bridges."

ELIZABETH, PA.—Concerning the proposed bridge over the Monongahela, to be erected here, our correspondent writes: "The Directory is determined to commence work on the bridge early in the spring. Will have plans and specifications in a short time."

McConnellsburg. Pa.—Our correspondent writes, concerning the report that a bridge was to be erected here, as follows: "Our Board of County Commissioners has erected one bridge this season, but have done nothing toward the second one, except procure estimates of cost of super and sub structures."

BRIDGEPORT, CONN.—A small bridge is to be built here.

TORONTO, CAN.—It is probable that two bridges will soon be erected here.

WASHINGTON, D. C.—A bridge is to be placed over the Potomac by the B. & P. R. R. HAMILTON, CAN.—The Niagara Central

HAMILTON, CAN.—The Niagara Central Railroad will construct a bridge here. Address the Common Council for details.

Digitized by

WRIGHTSVILLE, GA.—Laurens County has voted to issue bonds to the amount of \$15 000 for the purpose of building an iron bridge across the Oconee River at Dublin.

CHATTANOOGA, TENN.—The Market Street Bridge Co. is arranging for building a bridge, probably of iron. across the Tennessee River, at this place. Plans are being prepared.

WFSTFIELD, MASS—Our correspondent writes: "We have ordered the town of Chicopee to construct a bridge over canal about 80 feet long, not less than 72 feet, with 20 feet driveway; sidewalk on each side of 5 feet; the whole to carry a load of 80 pounds per foot, with a factor of safety of 4."

FORT WORTH, TEX —Our correspondent writes: "No action had as yet, but a petition is now before the City Council to assist in building a bridge in which private parties are mostly interested. I do not think it will go through, as we have a majority of the Councilmen elected in the interests of the people. It may go through next year."

GAS AND ELECTRIC-LIGHTING.

BROCKPORT, N. Y. — An electric-light plant will soon be established here.

COTTON WOOD FALLS, KAN.—An electriclight system is to be established here.

ALLEGAN, MICH.—A gas-well is to be bored

SIOUX CITY, IOWA. — The Sioux City Light, Heat, and Power Company has been incorporated. Capital stock. \$100,000. Emerson McMillan, and others, incorporators.

LOUISVILLE, KY.—It is reported that the Louisville Electric-Light Company will make extensive improvements to its plant.

REMERSBURG, PA.—A company has been formed here to supply the place with piped natural gas.

HOLLAND. MICH.—The residents of this place have requested the officials to do away with gas and substitute the electric light.

Brenham, Tex —An electric-light plant is reported to be erected. The Mayor can give information.

VANDALIA, ILL.—The City Council has granted to George W. Brown and others a franchise of the streets and alleys for thirty years for the purpose of laying gas-mains and pipes. The company will be known as the Vandalia Light and Fuel Company.

SYCAMORE, ILL.—It is probable that this town will soon have electric lights.

FREMONT, O.—The City Council has contracted with the Fremont Electric-Light Company, to furnish 30 lights at \$95 each per year, and it is expected that the plant will be in operation by January I.

IONIA, MICH.—The village officials think of substituting electric lights for gas in this place.

HAGERSTOWN, MD.—An electric-light company is being formed here for the purpose of lighting the public streets.

CHETOPA. KAN.—The question of establishing an electric-light system is being agitated here.

JAMESTOWN, DAK.—The Board of Trustees of the Insane Asylum Home contracted with the Edison Electric-Light Company, of New York, for a 220-light plant.

RAILROADS, CANALS, ETC.

LITTLE ROCK, ARK.—The City Electric-Railway Company will begin operations early in the spring, and are now getting figures on all kinds of plant. The line will be a dummy line, and three or four miles will be put in operation as soon as possible.

NEW ALBANY, IND.—A street-railway is to be constructed here by the New Albany Street Railway Company.

Los Angeles, Cal.—General Solicitor Bunson, of the Atchinson, Topeka, and Santa Fe Railroad Company, says that the company will build a road to Redondo Beach, 16 miles south-west of Los Angeles, to be in running order March I.

BIDS OPENED.

COLUMBUS, NEB.—Synopsis of bids for erecting a bridge over the Loup River, opened December 12 by John Stauffer, County Clerk:
King Bridge Co., Des Moines, Iowa, 4 span, 248 feet, superstructure only, \$27.024, with foundations complete. \$38,000; 5 span: 108 feet, superstructure only, \$24,500; with foundations complete. \$28,100

foundations complete, \$38,199.
W. J. Hobson, St. Joseph, Mo., 5 span of 198 feet or 4 span of 248 feet, complete, for

Milwaukee Bridge and Iron Works, Mil-Milwaukee Bridge and Iron Works, Milwaukee, Wis., 4 span, complete, \$38,300; 5 span, complete, \$37,909.

G. F. Fox, Norfolk, Neb., 4 span, complete, \$37,800; 5 span, complete, \$37,400.

Smith Bridge Co., Minneapolis, Minn., complete, for \$41,000.

Wrought Iron Bridge Co., Canton, Ohio, wrought Iron Bridge Co., Canton, Ohio, and the span and the for \$41,800; 5 span, complete.

4 span, complete, for \$41,800; 5 span, com-

4 span. complete, for \$41,800; 5 span, complete, for \$43,500.

Kansas City Bridge and Iron Co., Kansas City, Mo., 4 span superstructure, \$25,500; substructure, \$13,400—\$38,900; 5 span superstructure and substructure, complete, \$38,900.

Missouri Valley Bridge and Iron Works, Leavenworth, Kan., complete, as per plans,

\$38,900.

\$38,900.
P. E. Lane, Chicago, Ill., 4 span, complete, \$38,498; 5 span, complete, \$37,888.

Board awarded contract to the King Bridge Co., of Des Roines, Iowa, 4 span of 248 feet each, for \$38,000.

BROOKLYN, N. Y.—Synopsis of bids for repairing the turning gear of Hamilton Avenue Bridge, opened December 20 by the Board of City Works:

White & Price, work complete, \$3,900; Norman Hubbard, work complete, \$3,175; Patrick Fox, work complete, \$3,175; James Dillon, work complete, \$2,987.

ASHLAND, PA.—Council has awarded the contract for lighting the streets during 1888 to the Ashland Gas Company, who will turnish Thomson-Houston electric lights of 2,000 candle power at \$100 per lamp.

JUNEAU, WIS.—Synopsis of bids for furnishing apparatus and material and doing all necessary to heat the Dodge County Court-House by steam, opened December 14 by Louis Rushlow, Chairman of the Committee on Public Buildings:

Miller & Reichert, Watertown, I,650 square

feet of radiating surface and one boiler, \$1,885. Additional expenses of extras, \$425; total,

\$2.205.
Samuel I. Pope & Co., Chicago, 1.744 square feet of radiation and one boiler, \$1,659.
King & Walker, Madison, 2,000 square feet of radiation with covering, and one boiler,

f. 1,961.

C. L. Rundell, Oshkosh. 1,800 square feet of radiation, two boilers, all conducting pipes covered, \$1.961.

Krause & Barker, Milwaukee, 1,372 feet radiation, two boilers, and all pipes covered, in basement, \$1,704.

A. B. Taylor, Fond du Lac, radiation, 2,000

square feet. pipe covered in basement, two

boilers in one section, \$1,950.

Moores & Co., Milwaukee, put in three bids, one for \$2,500, one for \$1,800, and one for

\$2,000.
The contract was awarded to C. L. Rundell, of Oshkosh.

MILWAUKEE, Wis.—Synopsis of bids for furnishing and erecting the pumping engines and boilers for the flushing tunnel pumping station, opened December 22 by the Board of Public Works:

Public Works:

The specifications call for pumping machinery of sufficient capacity to raise and deliver continuously 32,000 cubic feet of water per minute, from three to three and a half feet high, with boilers and engines suitable for operating the machinery.

E. P. Allis & Co., of Milwaukee, offer to furnish a vertical compound condensing pumping engine to be placed in a water-tight caisson, about 24 feet long. 15 to 10 feet wide and 18 feet deep, iron influent and effluent conduit gates, and four boilers 54 inches in diameter and 16 feet long, for \$37,500. diameter and 16 feet long, for \$37,500.

The Quintard Company, of New York City,

submitted plans which provide for four small engines, instead of one large one, with the

accompanying machinery.

The contract was awarded to E. P. Allis &

PHILADELPHIA, PA.—Proposals were received at the Park Commission office, for the construction of certain heating apparatus in Horticultural Hall, made necessary by additions to the Hall. The specifications calling for a 30 horse-power Harrison boiler, with radiators, coils pipe and apparatus complete, and the following bids were received: H. T. Moss. \$1,803; Philadelphia Steam Heating Co., \$1,819; J. P. Wood & Co., \$2,000; Thompson Bros., \$2,097; H. B. Smith Co., \$2,000

Bids for lighting the streets of the city during the year 1888 with electric arc lights, of 2,000 candle-power each, were opened by Director of Public Works Wagner on December 24, and the following received:

From United States Electric Light Co., 50 cents per night for each light used from north side of Market to south side of Poplar streets,

and from Broad to Delaware River.

Brush Electric Light Co., 47½ cents each for lights south of Market, north of Spruce, from river to river; 50 cents each from south side of Spruce to north side of Washington avenue; in West Philadelphia, 50 cents each;

of Market, south of Callowhill and west of Broad streets. 47½ cents each.

Keystone Light and Power Co., 35 cents each from Arch to Walnut streets and from

north of Poplar and east of 13th streets.

Philadelphia Electric Light Co., west of Broad, north of Callowhill, 47½ cents each; north from Callowhill and 8th to Broad, 49½ cents; north from Callowhill, between 6th and oth, 52 1/2 cents each.

Germantown Electric Light Co., 55 cents

each for the lamps in Germantown.
Frankford Electric Light Co., all in 23d and part in 25th Ward, 55 cents each.
Wissahickon Electric Light Co., all lights

Wissahickon Electric Light Co., all lights in Manayunk at 55 cents each.

The bids for the coming year are somewhat of a reduction from the prices paid for 1887 This year the average cost for each lamp was 54½ cents per night, but the average for the next year will be about 50 cents, and the total cost for 1888 will be about \$95,000.

Boston.—The following proposals were received on Saturday, December 24, for rebuilding a wharf owned by the Paving Department: John J. Scully, \$6,375.45: J. N. Hayes & Co., \$6,700: William A. Norton, \$6,975; McInnis & Parker, \$7,645: Benjamin Young, \$6,326.50; F. G. Whitcomb, \$7,520; W. A. Kendrick & Son, \$6,609.50. The contract was awarded to Mr. Young, the lowest hidder.

NEW YORK CITY .- The contract for heat-NEW YORK CITY.—I he contract for heating and ventilating the new Freundschaft Club Building, of which Messrs. McKim, Mead & White, 57 Broadway, N. Y., are the architects, has been awarded, in competithe architects, has been awarded, in competition on plans and specifications prepared by Mr. Altred R. Wolff, Consulting Engineer, 38 Park Row, N. Y., to Messrs. Baker, Smith & Co., of New York. The contract price is \$15,169, including \$689 for switch-damper appliances. Messrs. Gillis & Geoghegan and Johnson & Morris were the other hidders. other bidders.

BUFFALO, N. Y .- Bids were opened Decemper 28 by the Commissioner of Public Buildings for the construction and furnishing Buildings for the construction and furnishing of the new public school, No. 24, on Fillmore Avenue. The lowest bidders are: For mason work, J. Boland, \$18,608: carpenter work, Jacob Jaeckle, \$14,825; cut stone, J. Boland, \$3,400: painting and glazing, Louis Baitz, \$1,680; steam heating and ventilating, Irlbacker & Davis, \$9,238; plumbing, R. J. Knepper, \$1,679. The lowest figures aggregate \$50,630.

ST. PAIL —The Board of Public Ward

St. Paul -The Board of Public Works have awarded the contract for sewer on Walnut Street to John W. Doherty for \$2,279.

STILLWATER, WIS .- The contract for open-STILLWATER, WIS.—I ne contract for opening and widening Water Street from Myrtle to Mulberry, with other minor improvements, has been awarded to F. H. Lemon & Co., at \$21,250, work to be completed July 1, 1888.

GOVERNMENT WORK.

GOVERNMENT WORK.

St. Louis, Mo.—Synopsis of bids for fur nishing and laying complete a 6-inch cast-iron water-pipe from St. Louis to Jefferson Barracks, opened December 8 by C. W. Foster, Quartermaster U. S. A., Depot Quartermaster:

R. J. Kilpatrick and Louis Grund, St. Louis, Mo., \$11.767; John O'Donnell & Brother, St. Louis, Mo., \$10,725; Joseph Ruprecht, St. Louis, Mo., \$11,700; Standard Foundry Co., St. Louis, Mo., \$11,840. The contract was awarded to the lowest bidder.

MISCELLANEOUS.

LITTLE ROCK, ARK.—The City Electric Street Railway Company is seeking a good system by which to propel their cars. Any information on this subject should be addressed to Howard B. Adams, President.

ST. PAUL, MINN.—The City Engineer and the Board of Public Works have completed plans for a system of parks and connecting driveways and boulevards, and the same have been submitted to the City Council, who now have the matter under consideration. Their adoption is said to be a certainty and it is considered altogether probable that the county will extend the system still further. Several thousand dollars will be expended in the undertaking.

BIRMINGHAM, ALA.—A tunnel to cost \$12,500 is to be built here. Address W. H. Hughes.

NEW CORPORATIONS.

Boston, Mass.-A certificate of incorporation has been issued to the National Hot-Water Heater Co., of Boston, who will undertake the manufacture and sale in the United take the manufacture and sale in the United States of the Spence hot-water boilers for heating buildings by hot-water circulation. These heaters have been made and extensively sold throughout the Dominion of Canada by Rogers & King, of Montreal.

James C. King, of Montreal, is President, and Daniel Simonds, Vice-President and Treasurer of the Simonds Manufacturing Co., Fitchburg, Mass., is Treasurer. The offices of the company are at 191 Fort Hill Square.

The Crockford Steam-Generator Company

THE Crockford Steam-Generator Company, Newark, N. J. Capital stock \$100,000. Ebenezer A. Smith and others, incorporators.

THE Sterling and Rock Fall Natural-Gas and Mining Company, at Sterling, Ill. Capital stock, \$2,000. Incorporators, J. V. Mc-Carty, Charles Hubbard, and others,

MADISON, WIS -Articles of incorporation were filed December 27 by the Standard Brick Company, of Milwaukee, with capital stock of \$50,000. Articles were also filed by the Wood-land Iron Mining Company, of Lavalle, Sauk County.

PROPOSALS.

(Continued from page viii.)

WATER-WORKS.—Proposals are wanted at Dal las, Tex., until January 11, for constructing, etc., two storage and subsid ng reservoirs, according to specifications. Address W. E. Farry, City Secretary.

WATER WORKS.—Proposals are wanted at Hillsbore, ill., until January 12, for constructing waterworks. Address the City Clerk.

SEWERS.—Proposals are wanted at Williamsport, Pa., until January 18, for the construction, etc. of sewers in ceitain streets. Address R. H. Faries, City Engineer.

WATER-WORKS.—Proposals are wanted at Washington O., until January 9, for the construction of a complete system of water-works. Address H. L. Hadley, of the Water-Works Committee.

PROPOSALS will be received at the City Engineer's Office until the roth day of January, 1888, at 2 o'clock P. M., for building the North Minneapolis Fumping Station. Plans and specifications can be seen at this office. For further information address Andrew Rinker, City Engineer.

FIRE-HYDRANTS.—Proposals will be received at the office of the Board of Public Works until Friday, January 6, 1388 at 10:30 o'clock A. M., for furnishing for the Water Department of the city of Milwaukee roo double-nozzled fire-hydrants of the "Single Valve Vatthews" or "improved Stowell" pattern. For further information address Commissioners of Public Works, Milwaukee, Wis.

Works, Milwaukee, Wis.

WATER-PIPE.—Proposals will be rec-wed at the office of the Board of Public Works until Friday, January 6, 1888, at 10:30 o'clock A. M., for furnishing 1,000 tons of cast-iron water-pipe for the water-mains of the city of Milwaukee, with the privilege reserved by the Board of Public Works of increasing the amount to 2,000 tons, the said pipe to be delivered at the pipe yard in said city, in accordance with specifications on file in this office. The pipe to be of the following quantities and 3 test-viz: 100 tons of 12-inch, 260 tons of 8-inch, 600 tons of 6-inch, 30 trins of 4-ii c., and to ton of 3-inch water-pipe, and the additional 1,000 tons of ordered, to be 6, 8, 12, 16, and 20 inch, the amount of each to be d-termined hereafter. For further information address Commissioners of Public Works.

PROPOSALS for the work and material to be furnished in enlarging the drill-hall of the State Armory in Brooklyn, N. Y., and providing a fence around the said armory grounds, will be received, u. til January 13, 1888, at the State Arseral, Thirty-fifth Street and Seventh Avenue, New York City. Plans and specifications may be seen at the office of architect. Edward F. Gaylor. 66 Broadway, Brooklyn, N. Y. Proposals must be addressed to the undersigned Commissioners. Josiah Porter, Adjutant General; Emil Schaefer, Inspector General; J. M. Varian, Chief of Ordnance, Commissioners.

PROPOSALS.

WATER-SUPPLY.—It is reported that the Board of Public Works of Jersey City. N. J., will advert se for propesals for a new water-supply to be delivered at the Belleville Reservoir.

ARTESIAN WELL.—Proposals are wanted at Devil's Lake, Dak., for sinking an artesian well to a depth of about 2,000 feet. No date specified. Address the Town Clerk.

WATER-WORKS SUPPLIES. — Proposals are wanted at Mount Morr's, N. Y., until January 20, for furnishing cast-iron pipe, hydrants, boil-rs, engine, and pump, according to specification. Address George W. Fhelps, Mount Morris, N. Y.

SEWERS.—Proposals are wanted at Pittsburg. Fa., until January 3, for sewers and street work. Address E. M. Bigelow, City Engineer.

BRIDGES.-Proposals are wanted at Council Bluffs, Iowa, for the construction of all bridges that may be ordered during the year, to date from April 1. Until January 4. Address John Clausen, County Auditor.

SCH DOL.—Proposals are wanted at Gaine's Station, Mich., until January o, for electing a blick school house. Address School Building Committee, Gaine's Station, Mich.

BRIDGES.—Proposals are wanted at Kansas City, Mo., for the construction of nine bridges. No date specified. Address County Clerk Burr.

SCHOOL.—Proposals are wanted at Gloucester, Mass., until January 25, for erecting high-school building. Address John J. Somes, Clerk of Building Committee.

SEWERS. - Proposals will be received, until January 16, 1883, by the Board of Public Works, for constructing sewers in various streets. For further information address Martin Finck, Clerk, Jersey City, N. J.

TOWN HALL AND SCHOOL.—Proposals are wanted at Southbridge, Nass., until Jarvary 16. for the construction of a town hall and high school building. Address Sylvester Dresser, Chairman of Building Committee.

BRIDGE.—Proposals will be received at Hunting-burg, Ind., until January 18, for constructing a recotoot span from bridge, twelve feet wide. Address A. H. Korner, County Commissioner, at County Auditor's Office.

SEWFRS.—Proposals are wanted at I a Fayette, Ind., until January 9, for constructing sewers in certain streets. Address the City Clerk.

STEAM-HFATING.—Proposa's are wanted at Brooklyn, N. Y. until January 5, for furnishing, etc., st am-heating apparatus for different city buildings. Address George Ricard Conner,

PIPE AND SPECIALS.—Proposals are warted at Albany, N. Y., until January 8. for pipe and castings as follows: Pipe, 165 tons 12-inch, 136 tons 12-inch, 169 tons 20-inch, 710 tons 24-inch. Specials, 4 tons for 12-inch pipe, 7 tons for 18-inch, 12 tons for 20-inch, 44 tons for 24-inch. Address H. E. Sickles, Secretary Special Water Commission, 25 North Feat Street.

ELECTRIC LIGHTING.—Proposals are wanted at Urangeville, P. Q., until February 1, for fiften electric lights for the town. Address A. A. Hughson, Town Clerk.

TOWER AND WATER TANK.—Proposals are wanted at Hopedale. Itl., until January 2, for the erection and completion of a 40-foot tower 21 d 2 16x14 toot water-tank for the water-works. Address J. P. Waldon, Town Clerk.

PIPE SEWFRS.—Froposals are wanted at Santa Rosa, Cal., until January 3, for constructing sewers and supplying 7,150 feet vitrified iron-stone sewer-pipe. Address C. A. Hoffer, City Clerk.

COUNTY JAIL.—Proposals are wanted at McDonouch, Ca., until February 15, for a new jail for Henry County. Address William H. Nelson.

PUMPING MACHINERY.—It is reported that the Board of Water Commissioners, of Sandusky, O., will advertise for preposals for pumping machinery. Address Charles E. Judson, C. E., Superintendent of Water-Works.

WATER-PIPF.—It is reported that the Trustees of Lake, Ill., w.ll readvertise soon for proposals for water-

CULVERTS AND STREET WORK.—Propesals are wented at Cincinnati, O., until Janurry 19, for work in several streets. Address Thomas G. Smith, President Board of Public Affairs.

WATER-WORKS.—Proposals are wanted at Pristol, Tenn., for a system of water-works to be constructed in the spring. Address Mayor J. W. Nowell.

CITY HALL .-- It is reported that new bids are to be received for erecting a city hall here.

SEWERS.—Proposals are wanted at Newark, N. J., until January 6, for constructing sewers in certain streets. Address Thomas H. Hickey, Chairman of Sewer Committee.

PIPE AND CASTINGS.—Proposals are wanted at Merritton, Ont., until January to, for about 750 tons of cast-tron water-pipe and a quantity of special castings. Address R. Clark, Secretary Water Commissioners.

SEWERS AND DRAINS.—Proposals are wanted at Cincinnati, O., until January 16, for constructing sewers and drains in certain streets. Address Thomas G. Smith, President Board of Public Affairs.

WATER-WORKS.-The city of Centralia, Ill. wants water-works on the franchise plan. Address the Water-Works Committee.

FLECTRIC-LIGHT SYSTEM. - Proposals are wanted at Burlington, N. J., until January 3, for an electric-light system. Address the City Clerk.



PROPOSALS.

CAST - IRON WATER - PIPE, SPECIALS, VALVES AND HYDRAN'IS.—Proposals are wanted at Kalamazoo, Mich., until January 11, for 18,000 feet cast-tron water-pipe, in different size and weight 55 valves and 25 hydrants. Address Chauncey Strong, City Clerk.

IRON FOUNDRY.—Proposals are wanted at Lorain, O., for erecting, etc., a building to be used as an iron foundry. Said building to be T shaped, 70x 100. No date specified. Address the Lorain Manufacturing Company, Lorain. O.

HEATING FIXTURES.—Proposals are wanted at Cincinnati, Ohio, until lanuary 2, for furnishing, etc., heating apparatus for the various sel ool houses of the city. Address W.W.Wright, Chairman Committee on Heating Fixtures. on Heating Fixtures.

WROUGHT-IRON PIPE, ETC.—Proposals are wanted at St. Louis, Mo., until Jaruary 5, for furnishing lime, brick, cement, lumber, hardware, wroughtiron pipe, vitrified pipe, and fittings, etc., as enumerated. Address lames M. Moore, Deputy Quartermaster General, U. S. A., Depot Quartermaster.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s. brown stone; br. brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apar nent-house ten, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

Houston st, s w cor Clinton st, one br tenement and stores; cost, \$35,000; o, D Zimmermann; a Wm Graul.

44 Perry st, one br tenement; cost, \$21,000; o, Charles Guntzer; a, Wm Graul.

2367 Second av, one br tenement; cost, \$14,000; o, Beekman estate; lessee and m, W C Spears; a, J S Wightman.

83d st, n s, 400 w oth av, one br stable; cost, \$30,000; o, E W Bedell; a, Thom & Wilson.

113th st, s s, 100 w 5th av, four br dwells; cost, each, \$14,000; o, W C Burne; a, J C Burne.

Es Av A, 52 s 77th st, 2 brick flats and stores; cost, \$32,000 all; o, John Van Dolson; a, Geo B Pelham.

Ss 143d, 250 e 8th ave, 2 brick flats; cost, \$30,000 all; o, Thos J O'Kane; a, J Albert Webster.

42 Perry, br flats; cost, \$21,000; o, Charles Guntzer; a, Wm Graul.

N s 113th, 130 w 11th av, 2 br dwells; cost, \$24.000 all; o, J C Desuris and wife; a, A B lennings.

456 9th av, br flats and stores; cost. \$20,-000; o, Elizabeth Hafour; a, M V B Ferdon.

BUILDING INTELLIGENCE.

N s 25th, 85 e 9th av, brick ten and store; cost \$14,000; o, Hugh Getty; a, George B Pelham.

BROOKLYN.

N s Lexington av, 200 e Stuyvesant av, 5 br dwells; \$22,500 all; o, Geo Walker; a, John E Dwyer,

N s Kosciusko st, 100 e Reid av. br ten; cost. \$7,000; o, Mrs M Mulvihill; a, H Voll-

N s Putnam av, 237 e Sumner av, 5 dwells; cost, \$30,000 all; o, Chas Isbill; a, not given.

S s Berkeley pl, 105 n w 8th av, br dwell; cost, \$13,000; o, James Foster; F Carles Merry.

S s Pacific st, 150 e Bedford av, 2 brick dwells; cost, \$16,000 all; o, D H Fowler; a, Geo P Chappell.

S w cor Central and Woodbine avs. 2 frame dwells and stores; cost, \$8,600 all; o, Charles Welir; a, H Vollweiler.

S s Richardson, 162 e Lorimer, 7 fr dwells, cost, \$24,500 all; o and a, Martin Reynolds.

N s Melrose st, 250 e Hamburg av, 2 frame tens, cost, \$9,000 all; o, Daniel Kreuder; a, Chas Hoering.

Es Rodney, 64 s 2d, brick factory; cost, \$35,000; o, Chas H Reynolds; o, Th Engel-

BROOKLYN-ALTERATIONS.

639-641 Broadway, br store; cost, \$12,000; o, H Battermann; a, Th Engelhardt.

MISCELLANEOUS.

MANKATO, MINN .-- A new hotel is planned, to cost \$100,000, to be 130x130, four stories high. T Saulpaugh, of Minneapolis, proposes to build it.

MINNEAPOLIS.—W B Dunnell has been appointed architect of the Soldiers' Home to be built at Minnehaha Falls. The cost will be \$30,000.

ST. LOUIS, MO.-Four permits issued costing less than \$7,000.

WORCESTER, MASS. — Nothing over \$7,000 to report.

SPRINGFIELD, MASS.-Nothing to report this week.

CHARLESTON, S. C.—214 Meeting, a br fire-engine house 2 stories high; cost, \$15,-000; o, city property; a, City Engineer Louis Barbot; b, C McK Grant.

BUILDING INTELLIGENCE.

BOSTON.—West Newton to Rutland, brick bldg for Little Wanderers' Home; cost, bldg for Little Wanderers' Home; cost, \$90,000; o, Trustees of Little Wanderers' Home; a, Geo F Mecaham; b, Cressey &

59-61 Tremont and 1-3 Beacon, br mercantile; cost, \$140,000; o, heirs of John L Gardner; a. Cummings & Sears; b, Whidden, Hill & Co.

Palmer, near Harrison av, brick stable; cost, \$15,000; o, T J Crosby; b, C E Ba:e-man; b, A Phaneuf.

202 Causeway, br store; cost, \$11,000; o, Otis Minot; b, W F Lean.

Unnamed street near Crafts, br manufacturing; cost, \$35,000; o, Crosby Steam Gauge and Valve Co; a, T Griffin; b, Gooch & Pray.

19 Kenilworth, br dwell; cost, \$7,000; o and a, C W Wellington; b, S P Tucker.

Washington, near Guild, brick car shop; cost, \$50,cco; o, Met R R Co; a, S W Lewis; b, John Lemk.

Washington, corner Poplar, br ladder and fire-engine house; cost, \$22,000; o, city of Boston; a, A H Vinal; b, Donahue Bros.

174-84 High, br mechanical; cost, \$7.000; o, Chacwick Lead Works; a. Wm S Ireston; b, A Lothrop.

429 Tremont, br bldg; cost, \$30,000; a, Cummings & Sons; b, Whidden, Hill & Co.

Warren av, br freight house; cost. \$12,-170; o, Fitchburg R R; a, E K Turner; b,

560-70 Atlantic av, br mercantile; cost, \$60,000; o, F Hathaway; a, B F Dwight; b, Sampson & Clark.

19-25 Eliot, br mercantile: cost, \$48,000; Charles H. Dell; a, A S Drisko; b, M S Miller and others.

250 Warren, br dwell; cost, \$7,500; o, Silas Potter; a, J H Beswick; b, Pepin and

19-27 Purchase, br mercantile; cost \$30,-000; o, S Q & J M Currier; a, J R Hall.

MECHANICVILLE, N. Y .- Fr bldg, stores, offices and theatre; cost, \$10,000; o, Stock Co; a, H P Fielding.

CHATTANOOGA, TENN.—9th st, 2 br stores, dwells, 3 stories, Chicago press brick, part iron front, terra cotta, sand-stone, plate glass; cost, \$10.000; o, M C Chambers, Chattanooga; a, Thos C Veale; b, Smith & Spencer.

OGDENSBURG.-Work starting up slow. No new work to report this time

BUILDING INTELLIGENCE.

MILWAUKEE .-- Fowler, bet 9th and 10th, warehouse and factory; cost, \$20,000; o, Kieckhefer Bros.

Broadway, refrigerating machine; cost, \$10,000; o. Val Blatz Brew Co; b, Weisel and Vilter Mfg Co.

8 bldgs less than \$7,000.

MONTCLAIR, COL.—A hotel to cost \$50,. ooo is to be erected here. For particulars address Baron Von Richthofen.

PHILADELPHIA.—Columbia av. w of 20th, addn to church building.

23d and Washington av, one 3-story br barrel factory; b, Thos Little & Son.

Germantown av, n of Ontario, 1 br hall; o, Jas. E Cooper.

6th, n of Columbia av, 1 br shed; b, Eldridge & Stewart.

S e cor 12th and Market. 1 br store; 0, Girard Estate; b, Allen B Rorke.

2 buildings less than \$7,000.

FORT WORTH, TEX .-- A jail is to be erected here.

SYRACUSE, N. Y.—A brewery to cost \$50,000 is to be erected here. Address Frank B. Haberle.

CHICAGO, ILL.—1273-75 W Van Buren, br st and flats; cost, \$12,000; o, A T Lay; a, W L Carroll; c, J E Davis

872 22d, br st and flats; cost, \$8,000; 0, Ahlgren; a, A Bessler; c, Scheerin

1070-72 W Harrison, br st and flats; cost, \$15,000: o and a, A Williams; c, Edwards & Perry

33-35 Washington, br st and flats; cost, \$12,000; o. C. G. Hutchinson; a and c, C. E Cook

366-72 Wabash av, br dwell; cost, \$40,-000; o, Wm Η Thomas & Son; a, H R Wilson; c, Geo Lehman & Sons

355-57 33d, br flats; cost, \$12,000; o, L. Schoenfeldt; a, E S Jennison; c, J E 1)avis

310 Marshfield av, br dwell; cost, \$8,-000; o, Thos Clark; a, H H Boyington; c, Thos Clark & Sons 2516 Quarry, br factory; cost, \$10,000; 0, O D Wetherell; a, W. H. Drake; c, L Mar-

NEW YORK CITY.—Plans were entered in Bureau of Buildings December 29 by L & J Brandt to erect 3 four-story brick flats on the northeast corner of 13th av and 83d st. which are to cost \$10,000.

John Sheridan is to build 2 five-story brick flats on the south side of 56th st. 375 feet east of 10th av, which will cost \$40,000.

Sent (post paid) on receipt of \$2.00.

THE FOLLOWING PUBLICATION IS NOW READY AND FOR SALE.

TITLE PAGE

A COLLECTION OF DIAGRAMS

Representing the General Plan of

TWENTY-SIX DIFFERENT WATER-WORKS,

Contributed by Members of the

New England Water-Works Association,

And Compiled by a Committee.

1887.

NEW YORK: PUBLISHED BY THE ENGINEERING AND BUILDING RECORD, 82 & 84 FULTON STREET.

INTRODUCTION.

OFFICE OF SECRETARY.

NEW BEDFORD, MASS., November 1, 1887.

NEW BEDFORD, MASS., November 1, 1887.

THIS collection of diagrams is the result of the persistent efforts of Messrs. Wirliam B. Sherman, of Providence, R. I., and Walter H. Richards, of New London, Conn., who, as a Committee on Exchange of Sketches, have secured these drawings from members of the Association. The following extract from a report presented by these gentlemen at the Manchester, N. H., meeting in June, 1887, will explain in part the origin of the collection:

"In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three water-works represented in the Association. Having this data on hand, though crude in many particulars, it was decided to put the same into available shape for the benefit of the members. This has been accomplished by the Committee without cost to the Association. From these rough sketches—revised, reduced to uniform size of 10 by 15 inches—a set of tracings has been made, and a sample tolio of blue prints prepared. This folio and set of tracings are herewith presented as forming the main part of this report."

Since the Manchester meeting three more subjects have been received and subscribtions for sets of reproductions from the tracings have been called for. The ready response to the call is evidence of the value of the Committee's work, and arrangements were made with The Engineering And Building Record for publication in this present form.

R. C. P. COGGESHALL.

RECORD for publication in this present form.

R. C. P. COGGESHALL,

Secretary,
New Fingland Water-Works Association.

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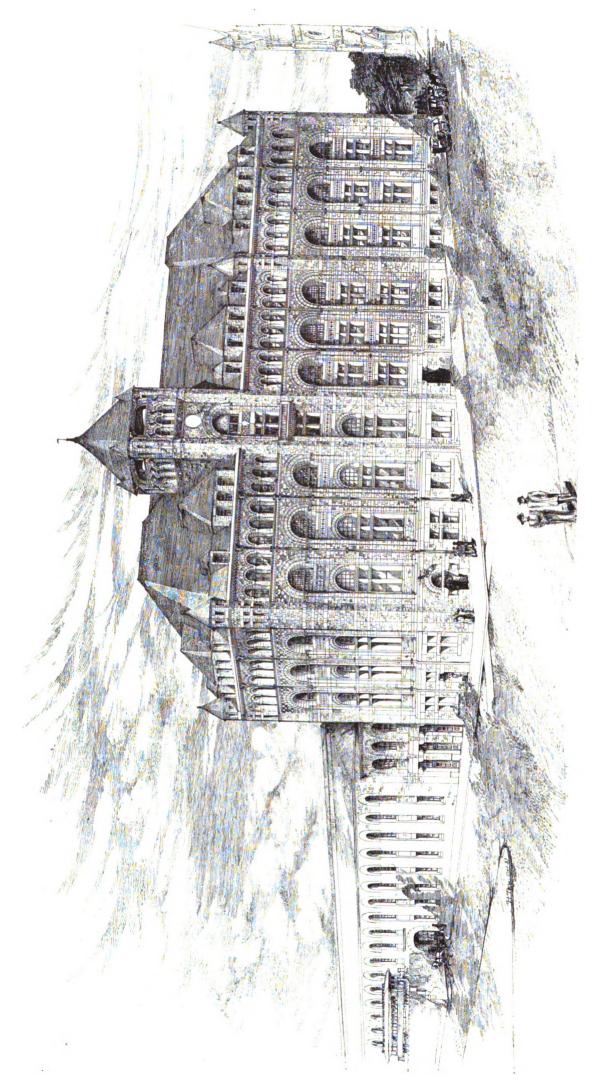
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THE CANADIAN PACIFIC RAILROAD DEPOT. MONTREAL, CANADA.

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THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE NEW YORK QUARANTINE VER-SUS NATIONAL QUARANTINE.

THE report of the committee of physicians requested by Mayor Hewitt to investigate the condition of the Quarantine Station of the port of New York will be found elsewhere in this issue. The substance of it has doubtless been telegraphed to all parts of the world. The character and professional standing of these gentlemen and their well-known desire to eliminate political effect from any statements they may make will no doubt compel the Legislature to take some action that will temporarily, at least, result in some improvement. We would, however, again urge the present Congress to pass a law providing for a system of National Quar-

The present disgraceful condition of affairs at the leading port of the country is the natural result of permitting a State to manage a matter vitally affecting the whole country, levying taxes and securing funds from the commerce of the world which is largely to be used by the political party in control in the State. The fact that the buildings and property in this instance are in such a wretched condition is because a Democratic Governor is unwilling that Republican officials shall handle the money needed to make them habitable. On the other hand, a Republican Legislature has for years refused to confirm the appointment of Democratic officials in order that the latter may be deprived of an opportunity of handling the funds that are received.

It is now announced that the Republican majority in the Legislature, realizing that public sentiment is so aroused that they must permit the appointment of new officials, propose to "dismantle the Quarantine fortress" by abolishing the present system of compensating the Health Officer by fees, which he has to divide with his party managers. It is proposed to pay him a salary, and have the fees collected go to the State. Whether, at this late day, this desirable reform is instituted or not, we simply call attention to the spirit that moves these State authorities in dealing with such a national question, and predict that no permanent improvement or adequate protection for the country at large will be received until the United States Government takes the whole matter in charge and becomes responsible for it.

PROGRESS IN CAR-HEATING FROM LOCOMOTIVE.

IT is a hopeful sign when we see announcements like the following in the daily papers from our railway companies in their efforts to secure patronage:

"The Wagner Vestibuled Limited trains, running over the New York Central and Lake Shore roads between New York City and Chicago, are the only trains between these points that are heated by steam throughout the en-

We understand that the Pennsylvania Railroad Company's vestibule train running between New York and Chicago is also heated by steam from the locomotive. On the other hand, we noticed that the cars on the 11 o'clock train from Boston on the Boston and Albany route on last Saturday were still heated by the car-heater, and on this occasion one of the heaters in the drawing-room car was so overheated that

there was a risk of the car taking fire; indeed, the wood-work of the door to the enclosure containing the heater was blisterea. This drawing-room car, though apparently a new one, had only single windows, which made it difficult to heat the car on a cold day with the pipes provided. The chairs were, also, so crowded into the space that it was difficult to turn them without incommoding a neighbor. On the whole, the impression made on the patrons of the road was one of petty meanness on the part of the management, unworthy of so wealthy a corpora-tion as the Boston and Albany Railroad Com-

CEMENT WATER-PIPE.

WE have received from Mr. L. Battin, C. E., of Elizabeth, N. J., a communication which particularly recommends a "cement wrought-iron pipe," which, he claims, has special features of merit. The points made in his communication are, First, that capitalists consider cement water-pipe to be an insufficient security for money loaned, and therefore the question of the true merits of these as compared with cast iron is lost sight of in the greater one of security for loans. greater security, according to Mr. Battin, would seem to be in the raw material. He truly says no lender ever yet dug up water-pipe to settle a claim, and, we may add, he probably never will.

The statement is made that out of 700 waterworks in the country, 150 use cement pipe. Also that twenty years' experience with forty miles of cement pipe, and an extended experience with cast iron, have made him give the preference to cement over iron pipe, the reason being that after twenty years' use it is free from all concretions and tubercles, and retains its full capacity, which is never the case with cast

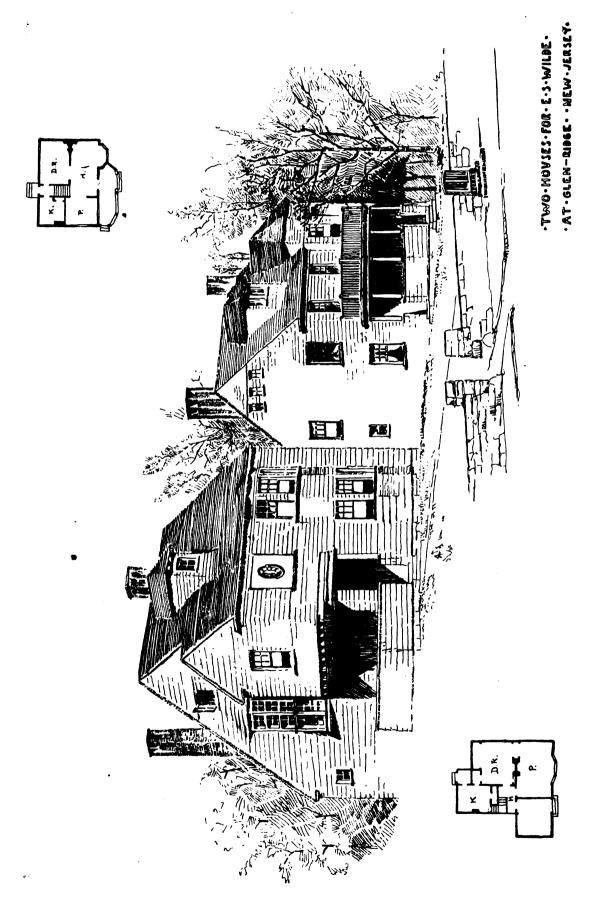
-He acknowledges difficulties in its Second .use requiring the best of materials and careful trenching. This brings in the mention of the patent pipe which has a perforated exterior iron jacket to retain and protect (until placed in the trench) the outer cement coating 3/4 of an inch thick which is put on this pipe at the factory.

We entirely dissent from the first proposition. Capitalists invest in water-works bonds because they believe the franchise and works, as a whole, of value, and they prefer cast-iron pipe because in almost all conditions it has been found most durable. We opine that the 40 miles mentioned are under a low head, and are no doubt doing good.work. Again, they are in a compact soil and not liable to settlement if laid with any care. We believe the experience with cement pipe where laid on yielding soil has been unfavorable, and from a neighboring city where under considerable pressure we learn there have been many failures at the service-taps. At such points the water gets access to the iron and gradually rusts it until failure ensues. Cement pipe when well laid under suitable conditions will no doubt give satisfactory results, but cast-iron will, as a rule, always be the mainstay for water-works.

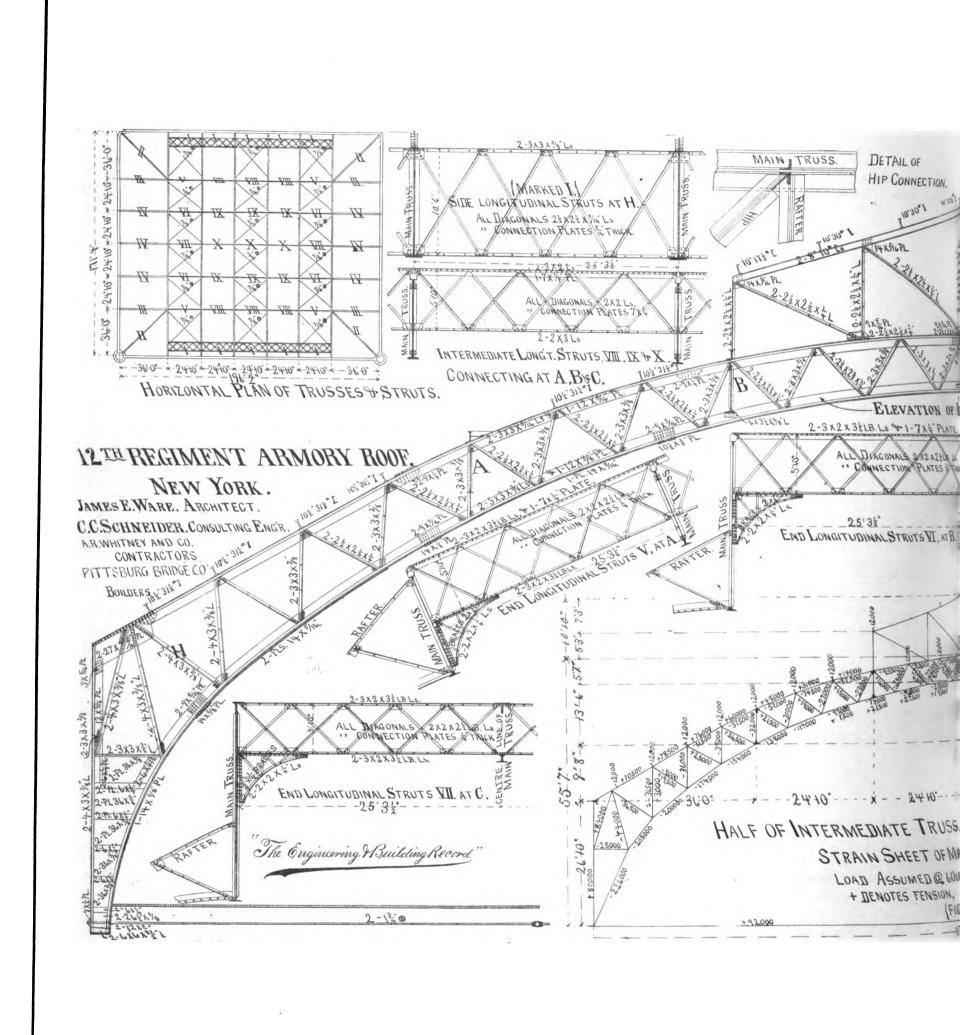
MICROCOCCUS SCARLATINÆ.

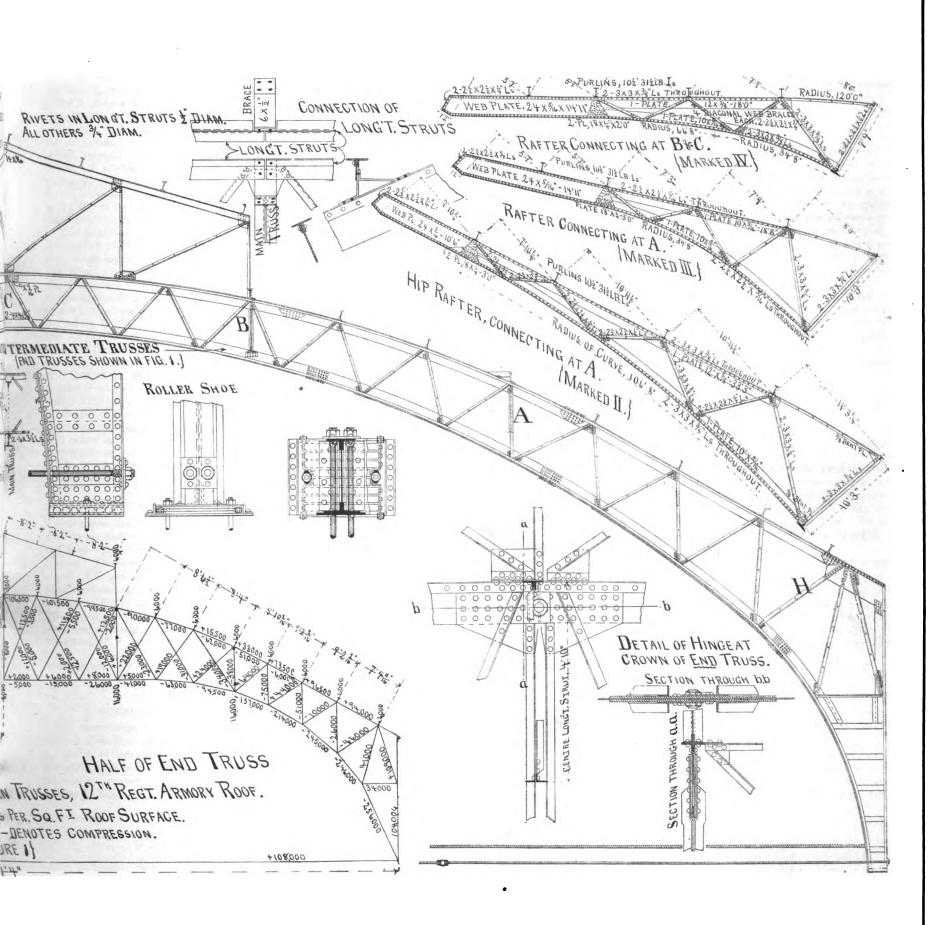
THE supplement to the sixteenth annual report of the Local Government Board of England, containing the report of the Medical Officer for 1886, forms a volume of 450 pages, which, as usual, contains much that is of interest, not only to sanitarians, but also to scientific men. If, for





W. C. HAZLETT, ARCHITECT.





example, we turn to the reports of the investigations of Dr. Klein into the cause of scarlet fever, it is certainly a matter of great interest to learn that he finds in the blood of children affected with scarlet fever a peculiar, very minute micro-organism which can be cultivated on gelatin or blood serum; that this appears to be the same sort of micro-organism as that which he had found the year before in sick cows, the milk from which had caused a small scarlet-fever epidemic, and that when this "micrococcus scarlatinæ," as he calls it, is inoculated on calves it produces in them a disease which seems to be identical with the disease of the cows above referred to. Furthermore, the same micrococcus was found in a tin of condensed milk which was one of a lot which seemed to be connected with a small outbreak of scarlet fever. It also appears that monkeys may be affected with a disease which, to say the least, is remarkably like scarlet fever, and that in one monkey thus affected the peculiar micrococcus was found in the blood.

The practical interest and importance of such researches is, of course, apparent, but even putting these aside, no one can read the details of Dr. Klein's experiments, and see how he took up and answered one question after another, without being interested in it merely as a specimen of scientific method. And while the evidence produced by Dr. Klein is not altogether satisfactory for several reasons, one of which is that there seems to be more than one kind of micro-organism connected with what we call scarlet fever in man, and that there may be more than one kind of scarlet fever, it nevertheless points unmistakably the direction in which further research should be made, and emphasizes the desirability that the Government should provide laboratory facilities and other means for making such researches, as being one of the best possible means of investing a small part of that "surplus" which at present seems to trouble some of our statesmen so much.

OUR ARCHITECTURAL ILLUSTRATIONS.

OUR special illustration is the new depot of the Canadian Pacific Railroad Company at Montreal, Can. Material used, stone, Scotch rubble face, with rock-face belt courses. The interior is hard-wood finish of Vancouver cedar. The general waiting-room, arched over, with granite column supports, carved cap, and arches finished in plaster. Floors made with iron beams, fire-proof finish. The cost is about \$250,000. There will be a train-shed about 500 feet long. The architect was Bruce Price, of New York.

TWO HOUSES FOR E. S. WILDE AT GLEN RIDGE, N. J.—W. C. HASLETT, ARCHITECT.

SUBAQUEOUS TELEPHONES.

WE seem likely before long to have some teasible method of telephonic communication at sea. Mr. Edison is reported to have signaled through a mile of the Caloosahatchie River in Florida, and by means of a submerged microphone, connecting with a telephone above, Professor Lucien J. Blake was able to receive subaqueous signals

from a locomotive bell a mile and a half away on the Wabash River and through three or four windings.

The Electrician also records some experiments of Mr. H. F. Boyer, of H. M. S. "Malabar," and presumably made on board that vessel. He uses a large submerged gong, operated from the bridge, to give the signals, and they are in turn received on a modified Bell telephone in the centre of the gong connected with an ordinary telephone on the bridge. Mr. Boyer has also used small explosions of gun-cotton in place of the gong, but, in view of the experiments of Messrs. Edison and Blake, it is rather surprising to find that he does not claim to be able to hear distinctly the explosion of one ounce of gun-cotton at a greater distance than one mile, unless the difference between smooth river-water and a rough sea will account for it.

Of course, in all the above methods it would be necessary to use the Morse alphabet or something like it. Such signals under the sea are independent of fogs or stormy weather; and they hold out the possibility of lighthouses and lightships being able to signal vessels at all times. Moreover, ships, in addition to signaling each other, could also signal lightships, or announce their number to marine telegraph stations, if the system proves successful.

THE MACHINERY OF SMALL BOATS.

A VALUABLE paper, entitled "The Machinery of Small Boats for Ships of War, etc.," was lately read before the British Society of Naval Architects by A. Spyer, Esq. This paper gives a résumé of what has been done during the past ten or twelve years to increase the speed and efficiency of small craft for naval and other uses. It gives a great deal of valuable data about the details of construction, including the power necessary to propel boats of different sizes at different speeds. It also gives particulars of the weights of various types of machinery, with their economy in fuel, etc. Parties interested in this subject can obtain copies of this paper gratuitously from Mr. Frederick M. Wheeler, of No. 93 Liberty Street, New York, who has published the article in pamphlet form.

PRECAUTIONS AGAINST FIRE IN NEW YORK THEATRES.

ALL theatres must have proscenium walls. All openings in proscenium wall to have double iron or tin-covered wooden doors. Roof over stage to have a skylight or skylights equal to ½ area of stage, opening automatically. All doors must open outwardly. Each gallery must have two staircases or equivalent in fire-escapes.

The person having charge of any theatre shall cause

The person having charge of any theatre shall cause every means of exit to be conspicuously numbered, and shall have a plan showing each of said exits and referring to the numbers aforesaid printed in conspicuous type on the programme of the play.

The signal-boxes placed in a number of the theatres

The signal-boxes placed in a number of the theatres connected with the system of special building signals are each provided with a glass front and a mallet for breaking the glass to give access to the handle used in sending an alarm.

The chiefs of battalion shall detail for duty at theatres and places of public amusement where scenery and stage machinery are used, their best, most reliable, cool, discreet, and experienced men, who have served two years or more in the uniformed force of this department. They shall be on the stage a half hour before the performance commences, and remain after its close a sufficient time to make proper examination and assure themselves that all is secure from fire.

All lights used in theatres and all other places of public amusement shall be properly protected by globes, glass coverings, or in such other manner as the commissioners shall prescribe. THE ROOF OF DRILL-HALL OF TWELFTH REGIMENT ARMORY, NEW YORK.

This drill-hall roof forms but one of many interesting features of the large and appropriate armory building, which is further noticed in this issue.

The drill-hall has an unobstructed floor of over three thousand square feet for the comfortable execution of company tactics, and is handsomely spanned by six riveted arch trusses, hinged at the crown and tied at springing line by rods passing through the foot of the pedestal and carried across just below the floor-line. The arch web is of solid plates for 17 feet from the base plate, and the first 24 feet of extrados, up to top of wall, is vertical, enabling the truss to join neatly and imperceptibly to the brick-work, increasing the effect of solidity, while being actually independent of the walls it transmits neither weight nor strain to them and cannot rack them through distortions of its own members.

One foot of the arch is anchored to the masonry, the other is cardied on expansion rollers that are guided vertically and laterally, but permit temperature movements in the direction of the truss. The intermediate arch trusses are spaced 24 feet 10 inches centre to centre, and have a depth of 5' 7" at crown, the web members throughout forming a simple triangular bracing system of diagonal angles in pairs.

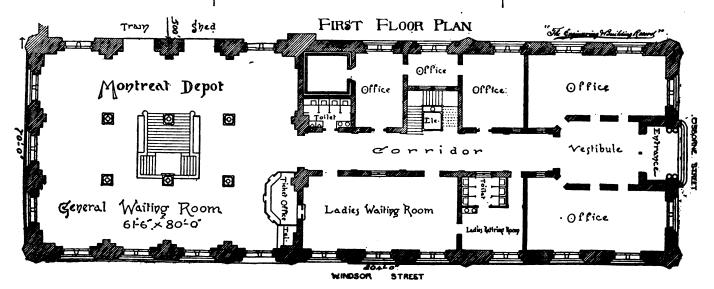
The end arch trusses are spaced 36 feet from the end walls and carry both square and hip rafters. Their strains are therefore greatly augmented, and while the upper roof line is preserved coincident with the other trusses the crown depth is increased to 19' 1" by dropping the lower chord; and the web bracing above the haunches becomes in effect a simple single intersection Warren girder. The greater crown depth also requires and is provided with special hinge in top chord and sliding joint in bottom chord, as shown in general illustration.

The rafters are a combination of plate and lattice girder, with top and bottom chords curved to correspond to the lines of the arch trusses. The connections are made at the intersections of the chords and of the lower chord and web. The chords are constructed with a vertical web plate forming a T-section, and affording easy connection of web diagonals. The purlins are rolled I-beams 10½ inches, 31½ pounds, spaced from 5 feet to 8 feet apart, and located, both on arch trusses and rafters, always at an apex of web members.

Simple Warren girder trusses, 5 feet and 6 feet deep, the diagonals of single and the chords of pairs of angles, form five lines of longitudinal bracing continuous from end arch truss to end arch truss and extend to end walls by rafters abutting in same vertical plane; their connections embrace nearly the whole vertical intersection of the intermediate arch trusses, and form an exceedingly stiff system.

After erection additional stiffness at the haunches was considered desirable, and two more lines of longitudinal girder struts, about ten feet deep, were added at the point H (see general drawing) in a plane inclined about 45 degrees from the vertical, to prevent lateral deflection of the bottom chords.

In the end and centre panels diagonal lateral rods are placed in the plane of the top chord, forming, with the struts and trusses, an efficient system of wind-bracing. A very wide lantern and ventilator surmounts the crown



and affords ample side lights. The entire roof is of steel. and all connections are made with steel rivets.

The arch trusses were shipped from the shop in eight segments each, and erected with three shear poles that raised the pieces into position and sustained them until bolted up and stayed by the struts and furring.

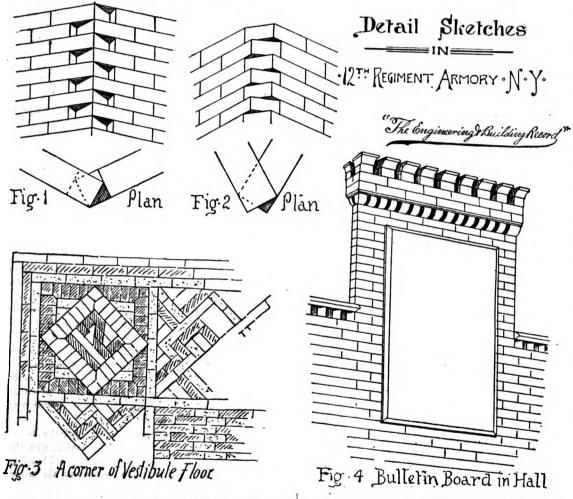
A novel and very economical and effective feature of the interior construction of the Drill Hall was the support of the balcony, carried in effect by longitudinal plate girders, which form a front panelling; and by the transverse plate girders which connect with these longitudinals, the main transverse girders are simple cantilevers supported by columns about nine feet from the extreme end, and built two feet into the solid wall, which anchors them by the weight of all the brick-work above. The longitudinal girders are carried by these cantilevers, and in their turn support the outer ends of the intermediate transverse girders which have no columns.

SOME ARCHITECTURAL FEATURES OF THE TWELFTH REGIMENT ARMORY.

FROM the quarry-faced granite base that everywhere underlies the structure, the walls of common brick, in red mortar, are raised. The long curtain-walls that stretch between the towers are gathered into buttresses of semi-circular form, which rise from the outer face of the granite base, while the walls between, starting on the same line, are reduced in thickness by a uniform batter about four for a height of five feet from the floor. It is laid in red mortar and capped with a saw-toothed and molded cours e of brick. The openings for doors and corridors have semicircular arches of brick, with label moldings like the dado cap. The walls from dado cap and from label moldings up and the ceilings are left in the browning plaster and treated with distemper.

As an example of the neat finish obtained with the brickwork note the sketch of bulletin board, Fig. 4.

The fire-places throughout are of Philadelphia pressed brick, with very little trimming of stone or granite, and no mantel, but a single shelf of stone. Some of those in company room have the crown molding of lockers carried across the breast The wood-work, except floor, is of oak, tinged with ammonia and finished antique. It is very sparingly used, and the moldings and trim are heavy and simple, being, like the quarry-faced granite, in harmony with the brick-work and rough plaster. The main hall, with its great oaken staircase with beams showing under landings and stairs, and the great trimmer beam supported in the centre by the large square newel-post. is in the style of the Fifteenth Century. The immense drill-room is simple in the extreme, the great iron and glass roof, which is in one clear span, giving every opportunity for free movement on the floor.



feet high, then are carried up perpendicular. They are again brought out by a series of arches that spring from granite corbels, and this corbel-course in turn carries a high parapet wall pierced at regular intervals with loopholes and coped with quarry-faced granite.

All the exterior walls, except a little about the main entrance, are of plain, unmolded brick-work. The semicircular buttresses are built of headers and the angles other than right angles are built as shown in Figs. 1 and 2 without cutting the brick.

The doorways are plain, massive arches of cut granite, and the walls about the main entrance are of squared granite to the sills of the second story windows, then are carried up in brick in the form of a tower with turrets and battlements. One steps from the granite threshold of the main entrance on to the brick pavement of the vestibule. which is of ordinary front brick in three colors laid on edge in patterns as shown in Fig. 3; the centre is of two colors only and shows the ends of the bricks.

In the halls the brick-work of the partitions is exposed

PAVEMENTS AND STREET RAILROADS.

No. XXV.

(Continued from page 68.)

REPAIRING, CLEANSING, AND WATERING.

FROM a report by Mr. George Livingston, C. E., Surveyor of St. George's, Hanover Square, London, we gather the following information.

There are forty-two miles of paved streets in the parish. With the exception of Piccadilly and two miles paved with other materials, all of these are macadamized, the road metal consisting either of granite, flints, or gravel. The labor of maintenance is performed by what is called a "lifting" gang, the men being paid fourpence per hour. The engineer and stoker of the road-roller receive more. This gang is supplemented for a part of the year by men called "district roadmen."

The average annual cost of maintenance of the macadamized streets, based on the traffic and cost of the past five years, is estimated at 2s. 6d. per yard for the future,

and the estimate for granite, including renewal in thirty vears, is a trifle more than one-half as much. The addition of cost of cleansing in each case would make the disparity still greater.

Four systems of maintenance and repair are discussed: First-By contract under fixed prices for labor and materials. The difficulties of determining the exact condition the streets shall be in at the expiration of the contract, and of getting efficient contractors is dwelt upon. The convenience of a large staff of workmen is also men-

Second-By piece-work or part contract. The vestry would by this supply the materials and the contractor the labor and tools.

Third-By a superior class of men in the employment of the parish. This is essentially the present plan, except that by offering a higher price for labor better men would be obtained.

Fourth-By the substitution of a different description of payement.

Street cleaning is considered one of the most important matters to deal with. It is done in part by contract and in part by the parish staff. There are in the employ of the parish in the "in wards" twenty-two men, one foreman, and a sweeping-machine. Men are paid 2s. 6d., foreman 3s. 6d. per day, beginning at 4 o'clock in the morning in summer and 6 o'clock in the winter. Sweepings are removed by carts as soon as possible. The sweepers are mostly paupers and cost more on account of small quantity of work done than a better class of labor. Having no water-proof clothing furnished them, no work is done in wet weather. In the out wards there are thirty-two districts, in each of which a roadman sweeps the crossings and collects the refuse by barrow for removal by the carts. He also does all repairing needed. The total annual cost for cleaning the streets is about £10,000.

"Notwithstanding this large outlay, the streets of the parish (in the opinion of the committee) continue to be most inefficiently cleansed. The nuisance most complained is, that the mud is swept from the centre and deposited in large heaps at the sides of the road in or near the chan-nel, where it is left for an unreasonable time to the great inconvenience of the public. The simple cause of this is that the streets which have been swept yield a greater quantity of mud than can, by the present system, be requantity of mud than can, by the present system, be removed. This is due chiefly to an insufficient staff of horses and carts to remove the slop and the difficulty attending its ultimate disposal. Any increase, therefore, in the staff necessary to perform this work more rapidly must entail additional expense.

"The difficulties in the way of a speedy cleansing of the streets, however, under existing circumstances are numerous. The chief are:

"First-The nature and condition of the pavement to be cleansed.

"Second-The imperfect method of sweeping.

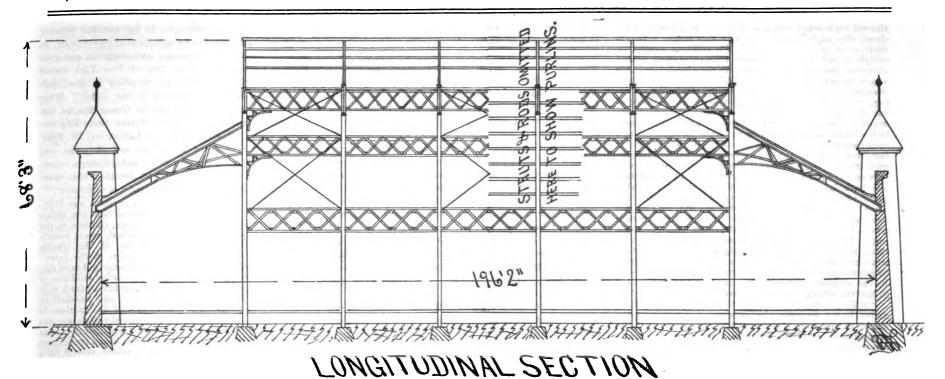
"Third-The amount of mud to be removed.

"Fourth-The objectionable and dilatory method of removal.

"The cleansing of the streets, both as regards its cost and efficiency, depends, to a very great extent, upon the description of pavement of which they are composed; and it cannot be disputed that macadamized streets (such as most of the thoroughfares of this parish), subject to heavy most of the thoroughtares of this parish), subject to heavy traffic, yield a much greater quantity of mud than any other pavement. For example, the average quantity of slop removed from the macadamized portion of Piccadilly (previous to its being paved with wood), between Engine Street and Hyde Park Corner, comprising an area of about 8,600 yards, was seldom less than from 25 to 30, and frequently of the second second part leads a day in most weather. quently as much as 40 cart-loads a day in wet weather; notwithstanding this, the roadway was never in a satisfactory condition. Whereas, since it has been paved, the average quantity of slop removed, under equal conditions, tory condition. Whereas, since it has been paved, the average quantity of slop removed, under equal conditions, from the entire length of the roadway—nearly three-quarters of a mile—representing an area of about 20,000 yards, does not exceed 12 cart-loads a day, the greater portion of which is a valuable manure. Every one who has observed the roadway under the two conditions of pavement must be carefully of the year improvement that he have effected be sensible of the vast improvement that has been effected. I have no hesitation in saying that Piccadilly, which was formerly one of the worst kept and filthiest roads in the parish, is now, considering the labor employed, one of the handsomest, cleanest, and best kept thoroughfares in the

metropolis.
"The surface of streets, under certain conditions, is frequently covered with a thick, sticky, greasy mud, due to various circumstances, the state of the atmosphere, the situation of the street, and the influence of wind and sun, etc., which the present system of sweeping, especially on macadam, utterly fails to remove, and which is the occasion of serious accidents. According to some returns of the Registrar-General, the average annual number of persons killed in the streets of London is about 200, and the number injured by accident about 2,000. The greasy and elippers state of the streets is often the cause of these number injured by accident about 2,000. The greasy and slippery state of the streets is often the cause of these casualties.

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DETAILS OF TWELFTH REGIMENT ARMORY, N. Y.

"The macadamized roads, also, at times, are 'permeated with the solutions of the surface dung deposits, and become excrement sodden,' the dry decomposition of which neither the broom-sweeping nor the scraper can wholly remove; and the moist exhalations produced by street-watering (during the process of evaporation), especially in hot weather, are most offensive. As a matter of public health and safety, therefore, the perfect cleansing of the roads and streets is most essential. The quantity of mud and slop to be removed from the streets depends entirely upon the condition of their surface and the nature of the weather; and the accumulation swept from the streets of this parish, which averages about 30,000 loads a year, is so great that its speedy removal from all the streets is, under present arrangements, impossible. This is, in great measure, due to the fact that the entire bulk, after having been scooped up in shovelfuls, has to be removed by horses and carts. A more filthy, more costly, and less speedy method of street cleansing cannot be well imagined, and there are many who regard it as discreditable to the sanitary arrangements of this capital.

"If the cleansing of the streets is continued to be done

"If the cleansing of the streets is continued to be done on the present principle, there is an obvious remedy for the evils complained of, provided the necessary expense is incurred. Suppose, for instance, it is required to have the whole of the streets in the parish cleansed by a certain hour in the morning (say 10 o'clock), all that would be necessary would be to employ a sufficient number of men to sweep the mud and dirt from the streets before that time, and to make it imperative upon the contractor to remove it; but the cost of providing such a staff would be serious. In cleansing thoroughfares, especially those of great traffic, speed and efficiency are of the first importance; any scheme, therefore, to be proposed for the better cleansing of the streets must have regard to such results. One method which I venture to suggest, by which this might be effected would be by fixing in each of the principal streets of the parish a number of hydrants, at convenient distances apart, to which suitable lengths of hose-pipe could be attached. By this arrangement, the whole length of a street could be thoroughly cleansed in a comparatively short time, and after the street had been washed by the application of water in this manner, and swept by an India-rubber broom or squeegee, made on the principle of the present horse-scraper, so as to remove any wet or moisture from the surface, it would be rendered perfectly dry and free from every description of filth.

"Under existing arrangements, the sweepings of the

"Under existing arrangements, the sweepings of the streets (as before stated) are removed by contract, and it is naturally the object of the contractor in performing this work to avoid as much cartage as possible; consequently, in wet weather, the mud and slop are often either left at the sides of the streets, or are, as is frequently the case, when opportunity offers, swept into the gullies. The adoption of the hose-pipe, however, would dispense almost entirely with scavengers, and also with the annoyance and labor of cartage; for, by the application of water, the sweepings of the streets would be put in such condition as to cause them to pass off immediately into the sewers.

"The passing of this liquefied mud through the sewers

"The passing of this liquefied mud through the sewers might be considered objectionable, as being likely to choke them up. I am of opinion, however, that, so far from creating any stoppage in the sewers, the operation would be most beneficial, as it would have the effect of flushing them. This hose or jet system is not new; and Mr. Heywood, the City Engineer, who tried it, states with reference to the effect it had upon the sewers that 'during the experiment in street-washing I had the gullies and sewers within the city carefully examined from time to time, when they were found to be not only as clean as they had previously been, but, if anything, cleaner; and, indeed, I think that if the surfaces of the city pavements were

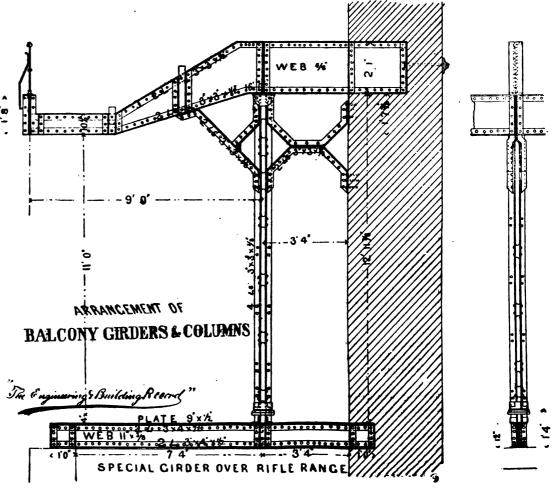
cleansed by water alone, both gullies and sewers would be cleaner than at the present time, for, as before stated, much dust or dirt is now swept into them in such condition that the usual current does not readily move it, whereas, if the streets were daily washed, nothing would go into the sewers excepting that which found its way there by reason of its fluidity.

of its fluidity.'

"Where the streets are paved as in the city, no reasonable objection could be raised to the adoption of such a system; with macadamized roads, however, it might be different. Under any circumstances, the hose-pipe would have the effect of thoroughly cleansing the streets of all their impurities, no matter what might be the nature of the pavement or the condition of its surtace; and it would be equally applicable and effective in all weathers, frost excepted. Under the present arrangements, and during dry weather, it is at times quite impossible to remove the dust and dung, etc., which accumulate in the streets, and which, as I have already stated, under certain conditions are the cause of offensive smells. To in part mitigate this nuisance. I have caused the streets to be swept during the early hours of the morning; and although this has genererally speaking been, to some extent, successful, it cannot

at all times be performed with good effect, for in certain seasons the ground is during the early morning so damp from heavy dews that sweeping alone fails to remove the dry dust and other offensive matter from the surface of the streets into which they have been firmly trodden. For the past two summers I have had the principal thoroughfares washed twice a week, and the result has proved so beneficial that during the excessively hot weather of last summer I had not one single complaint. Such a system of street cleansing would be the most successful method applicable, as cleansing by water produces a perfect state of cleanliness, by the removal of all decomposing matter. "Failing this scheme, the only other method I can sug-

"Failing this scheme, the only other method I can suggest is by making provision in the streets for the reception of the sweepings during the wet weather, which is quite practicable. The quantity of slop or mud swept from the macadamized roads on a wet day averages in this district from four to five loads per mile. In certain streets, of course, the quantity to be removed would be greatly in excess of this; but these would be the exception. All that would be required, therefore, would be to construct in each street a receptacle of sufficient capacity to contain the slop swept from its surface, and as the quantity to be



DETAILS OF TWELFTH REGIMENT ARMORY, N. Y.

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allowed for is small compared with the entire length of the street, this might be effected by a very simple arrangement—namely, the construction of a sufficient number of troughs in each street, at convenient distances apart, placed alongside the curb, and underneath the channel way into which the mud on the streets would be at once swept, and whence it could afterwards be carted. The great advanwhence it could afterwards be carted. The great advantage of this would be that in sloppy weather the whole of the mud and dirt swept from the surface of the streets would be immediately removed out of sight. The receptacles might be made fixed or movable as required, and constructed so as to present no unsightly appearance; in constructed so as to present no unsignity appearance; in fact, they would in appearance exactly resemble a length-ened street gully, except that provision would be made to prevent the entrance of storm-waters. In a thoroughfare like Park Lane, for instance, which on a wet day yields like Park Lane, for instance, which on a wet day yields about thirty loads of slop, thirty of these receptacles, placed at suitable intervals, each seven feet long by two feet wide and two feet deep, would be ample for the reception of the accumulated slop of the entire length of roadway. The contents would be removed in carts at leisure, either during the day or at night. Under existing arrangements the time occupied in filling a cart varies from twenty minutes to half an hour according to circumstances.

arrangements the time occupied in filling a cart varies from twenty minutes to half an hour according to circumstances. By the proposed arrangement a cart could easily be filled in half the shortest period now required.

"Failing both of these suggestions the only other alternative is to increase the number of horse-sweeping machines, and make it binding under heavy fines upon the contractor to remove the whole of the streets. A man with a ti is swept from the surface of the streets. A man with a broom will sweep about 3,000 square yards a day; a man

and horse with rotary sweeping-machine will sweep an area ten times as great—namely, say 30,000 yards.

"In addition to and in connection with either of these systems the erection of 'orderly bins' along the sides of the principal streets to collect the horse-dung and other matter which accumulates during the day would be of much use and greatly assist the work of cleansing.

much use and greatly assist the work of cleansing.

"In Paris the sweepings of the streets are not removed in carts as is the system here. There the London 'slop' cart is unknown, the refuse and mud is not permitted to remain on the surface of the streets, but is, with the aid of water, swept directly into specially-constructed sewers.

"The conclusions resulting from the foregoing may be recapitulated as follows:

"First—The work of repairing and maintaining the

be recapitulated as follows:

"First—The work of repairing and maintaining the parish roads would be more ecomically and efficiently performed by having ample accommodation for the storage of road material; by the employment of able-bodied laborers; and by discontinuing the use of macadam in all leading thereughlares thoroughfares.
"Second—Cleansing would be more rapidly effected by

such methods as the employment of hydrants, with receptacles for sweeping at the street sides; employing more horse sweeping-machines; obliging contractors to remove mud as swept up; increasing the number of parish horses and carts, etc., and discontinuing macadam in leading thoroughfares.

(To BE CONTINUED.)

REPORT OF THE MISSOURI RIVER COM-MISSION.

THIS report for the year ending June 30, 1886, contains among other things some valuable information as to methods of work; among the novelties being the introduction of steel tapes for accurate measurements, reported on by First Lieutenant Thomas A. Bingham and Assistant Engineer O. B. Wheeler. The mean probable error on a base line 9.712 feet long was I in 1,250,000. On another base 7,923 feet long the probable error was I in 140,000.

The adjusting apparatus for the use of the tape in measuring is also illustrated, together with its use, by photo-lithographs.

A standard gauge has been very successfully used for tide-gauge readings from bridges. It is arranged with a 14pound weight suspended by a steel wire cord, 1/8-inch in diameter, passing over a grooved sheave, which is attached by a lag-screw (on which it turns) to a track-stringer or other bridge timber. To the other end of the cord is attached a turnbuckle and lock-nut for taking up the stretch. A gauge-rod is attached horizontally to the stringer, with its zero properly adjusted, so that when the weight is lowered so as to touch the water the reading can be at once taken. This is reported on by Mr. A. H. Blaisdell, Assistant Engineer.

Mr. D. W. Willman, Assistant Engineer, reports on details of leveling and triangulation, organization of parties, method of fixing triangulation stations, and bench marks, etc.

The method used of leveling across rivers is described by means of which the results obtained are within a probable error of 0.0007 foot.

The Commission give details of successful work accomplished in stopping further caving of banks by the use of mattresses covered with stone. These reach 60 to 75 feet below low water and from 30 to 60 feet up the banks above it and seem to be permanent.

They outline their plans for the future, an I recommend an appropriation of \$1,000,000 annually. The design ation in the act of appropriation of a series of points where work must be done under a limited appropriation is justly criticised, as it is a simple waste of money to have a piece of work incomplete at the end of a season. The surveys of the river are still incomplete, some 2,000 miles remaining to be surveyed, which will require an expenditure of \$165,000 more.

Lieutenant Bingham also reports on the commerce of the river, and the great advantages to result from systematic improvement of the navigation. He makes the tollowing very pertinent observations:

"It is easy to see how by discriminations between local and through tariffs-added to the fact that the country along, or railroad, is to a great extent vassal to it-railroads can, by their combination, ruin the trade of a single highway. But it is not in these ways only that railroads have succeeded in practically suppressing the Missouri River traffic. The bridges are the obstacles to river trade.

"The advantage of a water route lies in the huge cargoes of barges that can be guided by one tow-boat. In a tortuous and swift stream, a large tow is difficult to handle at all times, but when the dangers are increased by a number of bridge-piers, not only blocking the highway, but giving rise to currents and eddies which not infrequently affect the river channel, the difficulties become so great that there are at present no barges run on the Missouri. Yet with the proposed channel of twelve feet barges could largely be used in spite of bridges." "The river can be so improved as to be permanently passable for huge fleets, and the saving (in freights) in one year would more than

pay for the improvements."

From the census of 1880 it is estimated that a saving to the producers of \$22,000,000 would be made for that one year by a properly improved river route, and this is more than twenty times the amount asked for by the commission for a year's expenditure.

Such figures as these are very suggestive, and it is only by constantly keeping them before the people that public sentiment can be educated to a proper appreciation of the immense benefit there is yet to accrue to the commerce of the country by a judicious expenditure in improving the waterways which Nature has so liberally provided.

"SIGNS IN THE HEAVENS."

AFTER listening to a recent sermon, entitled "Are Miracles Wrought Now?" it occurred to the writer that by means of a powerful stereopticon apparatus directed vertically upwards it might be possible on a dark night to cast a picture on low clouds that would be reasonably distinct to observers directly beneath it. Consultation with an expert in such matters has confirmed the impression of its possible feasibility, and the suggestion is given for what it may be worth.

It is hoped that nobody will mention this to the proprietors of washing compounds and patent medicines. It is bad enough to meet their advertisements at every turn on rocks, fences, and chimneys, but to walk out at night under a canopy of detergents and liver pills is a prospect too painful to contemplate.

MANY years ago, when the electric light was a new thing, it was exhibited on Boston Common, and pictures were thrown by it on the fountain in the Frog Pond, which were quite plain to observers on a line with the electric-light apparatus.

THE NEW YORK QUARANTINE ESTABLISH-MENT.

THE following is the report prepared by the Committee of the Academy of Medicine who were requested by Mayor Hewitt to make an investigation of the condition of the Quarantine Station of this port. This committee consisted of Dr. C. R. Agnew, Dr. E. G. Janewey, Dr. A. Jacobi, Dr. Richard H. Derby. The committee were accompanied by Dr. Herman M. Biggs, of the Carnegie Laboratory, Dr. Prudden, of the College of Physicians and Surgeons of this city, President James C. Bayles, of the New York Board of Health, and State Enginner Elnathan Sweet. They also secured the services of Mr. F. N. Owen, Mem. Am. Soc. C. E., to report upon the sanitary engineering features of the Station, and make suggestions regarding the necessary improvements.

Mayor Hewitt requested the committee "to make an early examination of the Quarantine establishment, to point out its defects and its requirements, in order to bring it up to the highest ideal standard of modern scien-

tific and medical knowledge; to estimate the amount which will be required to be appropriated by the State, in order to complete the necessary improvements, and gen. erally to suggest whether the city of New York should provide any further temporary hospitals in case there should be an outbreak of cholera in our midst." When the committee made its first visit to Quarantine, on Saturday, December 19, President Bayles, State Engineer Sweet, Dr. Biggs, of the Carnegie Laboratory, Dr. Prudden, of the College of Physicians and Surgeons, and Frederick N. Owen, engineer of Columbia College, accompanied them, and Drs. Biggs and Prudden were made members of the committee. The report is as follows:

"The first point reached in the explorations was Hoffman's Island. It should be remembered that the Quarantine establishment, port of New York, consists of the landing station at Clifton, Staten Island, where vessels arriving receive the official inspection of the Health Officer; and two miles below this station, in the Lower Bay, two islands, artificially made of rip-rap and sand filling. The more pothers of these islands called Hoffman in Bay, two islands, artificially made of rip-rap and sand filling. The more northen of these islands, called Hoffman, is dout two acres in extent; the more southern, near a mile distant from the former, is two across and one-half in size. Hoffman Island, in the system of Quarantine, is the place of detention. Off it detained vessels are anchored in the roadstead and exposed there to heavy seas when the wind is on the coast. To this island passengers and their hagging are taken from detained vessels by a when the wind is on the coast. To this island passengers and their baggage are taken from detained vessels by a small steam-tug when, in the opinion of the Health Officer, their detention is made necessary by prevalence among them of infectious diseases, or when such diseases

shall have existed on the ships in which they have arrived.
"The sick are sent immediately to Swinburne Island, to the hospital buildings which exist there.

to the hospital buildings which exist there.

"It is proper here to say that the Quarantine property, land, buildings, and plant generally owned by the State of New York, is in the custody of a body called the Commissioners of Quarantine appointed by the State and responsible to it. The Health Officer of the port, appointed by the Governor of the State and confirmed by its Senate, has no other control of the property and stations than that of police. He may use it without addition or modification, and so far only as may be necessary to enable him to discharge his duties in preventing the introduction into the port of New York of contagious diseases or infectious substances. In regard to the question whether Quarantine property and affairs should be under the jurisdiction of a National Government rather than a State Government as now, the committee is not called State Government as now, the committee is not called upon to express an opinion. The committee deems its business to be to point out such defects of the Quarantine establishment as are plainly apparent and easily remedied; to advocate such improvements in the plant at Quarantine as would render it a sufficient safeguard for the port of New York and the country at large if administered in a scientific manner.

As a related matter we would allude to the possible "As a related matter we would allude to the possible effect produced upon the business interests of New York and the country at large if cholera were permitted to invade the dense population of the city. It is estimated that \$100,000 a day is received by those hotels in the city of New York from which people would flee if an alarm of cholera existed here. The amount of money received over the counters of shops from those who frequent the city to have its innumerable wares cannot be estimated. It city to buy its innumerable wares cannot be estimated. It is millions. Hundreds of millions are annually produced in values in our various factories. To disturb the peace and industrial interests of the city by permitting the irruption of cholera through defects in quarantine would inflict an injury upon business beyond computation. The time consumed in reaching San Francisco by railroad is about that of the possible maximum period of incubation of cholera. The germs of any of the contagious diseases admitted into the port of New York by inadequate quaradmitted into the port of New York by inadequate quar-antine might be conveyed to any portion of the United States, fructifying as they went. Every citizen of the United States and British provinces has therefore a per-sonal interest in the condition of the New York quarantine. The existence of cholera in New York would cause the entire country to quarantine against the city. In this way inter-state commerce would be paralyzed or seriously embarrassed. As regards the effect upon the health and death-rate of the people we cannot even surmise, as that question would turn upon the efficiency of sanitary police. The law of cholera, its propagation, limitation, and extinction are so well understood that the disease may be said without presumption to be subject to scientific prevention or control.

With these few preliminary considerations your committee would now, in a cursory way, call attention to some of the manifest defects in the Quarantine establishsome of the manifest detects in the Quarantine establishment. In so doing they expect only to prepare the way for a thorough study of the subject. Thus steps may be taken to induce the Legislature, under appropriate law, to grant money enough to make Quarantine what it should be. The plans to do this should be speedily prepared by the State officers. If there is neglect in this matter and cholera, which has threatened to invade our port for more than three years and has recently been brought to Quarantine, should appear in the spring, and, favored by warm weather, pass an imperfect quarantine and reach New York City or Brooklyn, or possibly extend beyond to near or remote places, public opinion would seek out the blameworthy and visit them with a condemnation which no seclusion would be deep enough to smother or mitigate.



"The ground on Hoffman Island is soft, uneven, full of recesses in which water, refuse, etc., will be retained

of recesses in which water, refuse, etc., will be retained without any chance of their being cleaned. The wood walks are in the worst possible condition, interrupted, broken, rotten. The rip-rap of only one-half of the island is now supported by an inside wall of cement.

"The present buildings used for the residence of the people quarantined are hardly adapted for their purpose. They should be razed or remodeled.

"There is now almost no adequate separation of ages, sexes, or families. No suspected groups can now be isolated. There is no opportunity at all to separate those who may be amply able and willing to pay. There is no proper accommodation, bedsteads, bedding, tables, forks, knives, spoons, plates, or towels. As an evidence of the hardships caused by want of means of isolation a steamer is at present detained at Quarantine owing to the passengers and crew having been exposed to small-pox. They cannot and crew having been exposed to small-pox. They cannot be taken to the island, as there is no subdivision of the hospital of observation.

"The supply of water is insufficient, and warm water is almost entirely wanting.
"For a population now there of more than five hundred persons there are about four water-closets, each closet having three or four hoppers, some of which are not flushed at all, and all of which are old, badly constructed, and out of reposit and out of repair.

and out of repair.

"The cleaning and disinfecting plant is entirely inadequate in extent and efficiency, thus making it impossible to cleanse the persons of the quarantined or disinfect their luggage, either expeditiously or thoroughly.

"The 'sulphur-room' should not be where it is and as it

is; for, being on the main floor of a building occupied by masses of the quarantined, the latter are constantly exposed to fresh infection from clothing brought in to be disinfected and to the fumes of sulphurous acid when the door of the sulphur-room is opened.

"The island must be protected against the inroads of the sea. This may be done as may seem best to the State the sea.

Engineer:

-The rip-rap wall extending around the island should be made smooth and even to the water's edge.

"Second—The concrete wall, extending at present only part way around the island and inside the rip-rap, should

Third—A solid wall of masonry, with smooth surface and steeply sloping, should be laid on the face of rough stones, either on the line of or within the existing rip-rap.

"Fourth—A low wall might be built within the rip-rap, capped with stone or granite curbing, on which a broad walk should be constructed around the island.

"An iron fence on the outer edge of the wall should extend entirely around the island, in order, first, to separate the occupants of the island from the rip-rap, and, second, to prevent access of strangers to the island.

The surface of the island should be cemented or asphalted, and should be raised sufficiently above the exterior wall to allow of good drainage. It should be smooth and hard to allow of thorough cleansing and prevent

the lodgment of filth or germs.

The docks should be reconstruced and two in number the floorings made non-absorbent with concrete or asphalt.

One should be for general use and the other exclusive for the disenfectant plant. A covered landing stage should be constructed on the former, from which the sick in stretchers could be transferred to boats. A covered way should be provided from this dock to the large buildings and hospitals. It would be well to have a hand car, rails to be laid from the dock to the buildings.

"The surface of the island outside of buildings should

be divided by a wall or iron fence into two distinct

portions:
"A.—The part adjacent to the boat landing should be A.—I he part adjacent to the boat landing should be used for disembarking, disinfection, etc., and on this should be placed the cook-room and dormitory for employees and all other administrative appurtenances.

"B.—The remainder of the island should be divided by

walls into approximately equal areas, corresponding to the groups of people, each with a water front, and each one of these areas should be in communication with one only of the sets of apartments occupied by the separate

groups of people.

"It would be advisable to separate each of these yards from the water front by an open iron fence so as to leave a walk of about 10 feet in breadth around the island exclusive of the administration area. There should be on the outer or sea side of this wall another iron fence around

"The present administration building, if retained, and one of the largest buildings must be remodeled to answer for a new administration building, a disinfecting building and a storehouse.

If the present large buildings are to remain the roof should be repaired; each main floor should be subdivided into two or more portions by solid partitions to allow the into two or more portions by solid partitions to allow the grouping of the inmates according to age, sex, and relationship; each apartment should have a separate entrance and be thoroughly ventilated. This method should be condemned, however, unless absolutely unavoidable, as poorly-ventilated apartments would result. The best plan, and in the only soliton. and, in the opinion of the committee, the only sanitary one, would be to construct new fire and filth proof buildone, would be to construct new hre and hith proof buildings, tearing down the old ones as speedily as possible; or, if need be, one at a time.

"The present administration building should be remodeled or a new one erected. It should contain the medical

officer's apartment (who should also be superintendent) and quarters for an engineer, and with private kitchen;

also an extension in one of the docks, with a furnace suitable for burning actually infected articles brought in by passengers, kitchen refuse, etc.

passengers, kitchen refuse, etc.
"Separated from these apartments there should be a large kitchen, with accommodations for cooking meals for 800 or 1,000 persons; rooms for the attendants; boilerroom containing at least two boilers for adequate power and security in case of accident to one; engine, pumps, and apparatus for electric lighting; the sleeping and living rooms for the employees, with three rooms for the resident physician, may be placed in a separate building.

"There should be a small isolated building, easy of access to the dock, where persons taken suddenly ill could be at once placed prior to their removal to Swinburne Island. It should contain at least four rooms to admit of

the separation of the sexes and of diseases.

"The main buildings should be on the pavilion plan, of brick and iron, with two stories. Each should have a central hall, from which wings should radiate at right angles. These wings should constitute rooms capable of giving 500 cubic feet of air to each adult or every two children, and of a size to accommodate twenty-five per-

sons, with an extreme capacity of forty or fifty.

"A separate set of rooms should be provided for cabin passengers and those who could pay for better accommodations. [Here follow ordinary recommendations as to isolation of classes, construction of walls and floor in nonabsorbent materials. cellar ventilation, drainage, water-closets, lavatories, laundry, furniture, table utensils, meals, temporary suits of clothing to be used by emigrants while clothes are being disinfected, and towels.]

"The disinfecting plant should be situated in a separate building near the water's edge. The plant should consist of two or more large iron chambers lined with steam-pipes connected with a superheater, so that a dry temperature of at least 220° could be easily obtained. It should be arranged so that moist steam under fifteen or twenty pounds pressure could be introduced. The room in which the chambers are placed should be divided by a non-absorbent partition, and the materials to be disinfected should be separated at one end and removed from the other, this handling to be done by separate people. [Storage warehouses and the water-supply here received

attention.]

"It would be wise to fill up the present cisterns and construct new ones. * * * It would be well to provide for an emergency by having a large reservoir to which water could be brought in case of emergency. Water for drinking and cooking might be brought by boat from Croton supply. [Amusements, the advisability of having a skilled resident medical officer as Superintendent, etc., are here treated. Then, the recommendations are turned to Swinburne Island, where improvements are suggested in the approach from Hoffman Island; in the number and accommodation for attendants; in the height and ventila-tion of the pavilions; the water-closets; the means of disinfection, which should be similar to those recommended for Hoffman Island; in the morgue and in the means of disposing of bodies of the dead. All the buildings on both

islands should be fire-proof.]

"His Honor the Mayor wishes the committee to estimate the amount which will be required to be appropriated by the State in order to complete the necessary arrangements. * * To comply fully with the request, the ments. * * * To comply fully with the request, the committee would say that a commission should be formed, to consist of the State Engineer, the Superintendent of Public Works, the Mayor of the city of New York, the Mayor of Brooklyn, a representative from the New York Board of Health, the Health Officer of the Port, and the Commissioners of Quarantine."

Civil and Sanitary Engineer Frederick N. Owen recommends improvements in the line of the foregoing report.

Mayor Hewitt, after digesting the report of the committee, sent the following communication to Governor Hill on the subject :

MAYOR'S OFFICE, NEW YORK, December 31, 1887. To the Governor :

SIR: As you are aware, during the last summer and fall several ships arrived in this port from the Kingdom of Italy on which cholera cases were found to exist. Naturally very great apprehension of danger was excited in the public mind, and the quarantine arrangements of this port became the subject of much anxiety and some examination. A committee of the College of Physicians of Philadelphia made a very careful investigation of the provisions under the control of the Commissioners of Quarantine for preventing the spread of contagious dis-The report of this committee was so unvavorable that I deemed it to be my duty to ask the Board of Health of this city to prosecute the investigation and to invite a committee of the New York Academy of Medicine to make a thorough examination of the Quarantine establishment. This duty has been performed by Drs. C. B. Agnew, E. G. Janeway, Stephen Smith, A. Jacobi, T. Mitchell Prudden, Herman M. Biggs, and Richard H. Darby, physicians well known in the profession, and some of them specialists of great distinction.

I have now the honor to transmit herewith the report of this committee, with the accompanying documents. It discloses a condition of affairs which calls for the immediate action of the Legislature. It is evident that neither this city, nor the State, nor any other portions of the Union, are free from the dangers of the spread of contagious diseases, unless the Quarantine establishment at this port, under the control of the State authorities, is at

once reformed and reconstructed. The danger of delay is too imminent to admit of any postponement whatever have, therefore, the honor to request that you will transmit this report to the Legislature and recommend such action as will secure adequate provision against the dangers of contagious diseases which will be liable to break out as contagious diseases which will be liable to break out as soon as the warm weather approaches. It is not proper for me, as Mayor of this city, to suggest the mode of procedure which the State ought to take in reference to this pressing demand for the removal of the danger in our midst, but if, in the wisdom of the Legislature, a commission shall be formed to rebuild the establishment so as to bring it up to the highest ideal standard of modern scientification. tific and medical knowledge, I can assure you of the co-operation of the city authorities, and particularly of the medical profession, who have shown themselves to be fully alive to the dangers of the situation, which cannot be exaggerated. I have the honor to be, very respectfully, your obedient servant,

ABRAM S. HEWITT, Mayor.

THE ENGINEER'S RECOMMENDATIONS. REPORT OF F. N. OWEN.

Hoffman Island.—I. Removal of all timbering and the rip-rap breakwater to the level of low water of spring tides; on the foundation thus made to erect a concrete sea-wall the entire circumference of the island.

2. Remove the present defective docks and construct a

single pier on the channel side of the island of sufficient length to allow the quarantine boat to reach it at all stages of the tide.

The thorough disinfection of sewage before it passes

4. The removal of the present "barracks" and the construction of suitable buildings provided with the most approved means of ventilation, heating, drainage, etc.

5. The buildings should be lighted at night by elec-

5. The pullulings state tricity.
6. Water-closets and lavatories should be in semi-de-

7. Water should be supplied in great abundance, either a pipe under the bay from Staten Island; by a driven well on the island, or by large elevated storage-tanks sup-

8. An isolated building should be built for disinfection. both by steam and sulphur, and so arranged as to effect-ually separate the infected from the disinfected articles.

9. The entire surface of the island should be paved with either asphalt or concrete.

Swinburne Island.—I. A dock should be built on the channel side of the island so that the quarantine boat may

reach it at all stages of the tide.

2. The hospitals should be raised sufficiently to allow the free circulation of air beneath them.

3. Adequate means for the proper heating and thorough ventilation of the various wards should be provided.

THE DIFFERENT VARIETIES OF THUNDER-STORMS, AND A SCHEME FOR THEIR SYSTEMATIC OBSERVATION.*

BY THE HON, R. ABERCROMBY.

THE author shows that there are at least three distinct types of thunder-storm in Great Britain. The first, or squall thunder-storms, are simply squalls associated with thunder and lightning, which fly nearly with the surface of the wind. These form on the sides of primary cyclones. The second, or secondary thunder-storms, are associated with secondary cyclones. These move against the surface of the wind and are very rarely accompanied by squalls. Very little is known of the nature of these squalls, though they are the commonest type of thunder-storms in Great Britain. The third, or line thunder-storms, are apparently of a totally different nature. They take the form of long, narrow bands of rain and thunder, perhaps 100 miles long and only five or ten broad. They cross the country rapidly nearly broadside on. These are usually preceded by a very violent squall. The squall which capsized the 'Eurydice" was of this type. The air in thunder storms seems to circulate round a long horizontal axis, which would lie in the direction of the thunder-storm instead of round a short and nearly vertical axis, as in cyclones. The outline is given of a proposed scheme for the systematic observation of thunder-storms in England, by which it is hoped that the mechanical nature of the circulation of the air in every kind of thunder-storm may be discovered. It is also shown that if that particular kind of thunderstorm which is not associated with any distortion of isobaric lines can be worked out, a kind of rain could then be successfully forecast which is now very rarely announced. Forecasters now have to depend almost exclusively on synoptic charts of isobaric lines. To this extent they fail; but it is hoped that observations in the form and motion of clouds may be found to indicate the approach of rain when the barometer shows nothing.

* Abstract of a paper read before the British Association Meeting st Manchester, September, 1887, and published in the Electrician.



SOME DETAILS OF WATER-WORKS CONSTRUCTION.

No. VI.

(Continued from page 23.)

BY WILLIAM R. BILLINGS, C. E., Superintendent of Water-Works, Taunton, Mass. SERVICE-PIPE.

By common consent and general usage, the term servicepipe is applied to the tube which conveys water from the street-main to the premises on which it is to be used. In the majority of cases the service-pipe proper ends just inside the cellar wall, and the term house-pipes is a suitable one to apply to the tubes which convey the water from that

point to the various fixtures in the building.

There seems to be substantial agreement among those best qualified to judge that lead is the most suitable material for service-pipes, but in spite of this the first cost of lead pipe and the popular prejudice which is often found against it has prevented its adoption in many recently constructed works. This is not the place for a thorough discussion of the subject, but those who care to follow it are referred to a paper by Mr. Walter H. Richards, C. E., Engineer and Superintendent of the New London, Conn., Water-Works, which was published in the transactions of the New England Water-Works Association for 1884, and to Professor Nichols' "Water-Supply from a Chemical Standpoint."

Lead pipe is to be preferred because it is the most durable, the most easily worked, and the smoothest pipe now in the market. Its substitutes are plain wrought iron, tarred or enameled wrought iron, galvanized iron, and wrought iron lined with cement.

One's choice really lies then between lead pipe and

the question as to its healthfulness, leaving only the question of cost to be considered, and upon this latter point Mr. Richards' paper referred to gives some interesting figures.

TAPPING.

Except for special reason, a main should not be tapped for service-pipes until it has been filled, and, better still, if possible, not until it has been thoroughly flushed.

Cast-iron pipes must be entered by means of some sort of tapping-machine. There are several machines for this work upon the market, and one will not make a mistake in buying any one of them, provided it is offered by trustworthy parties. It is well to bear in mind, in selecting a machine, that it is to be carried about, and perhaps knocked about; that it is to be used in all sorts of trenches. wet and dry, muddy, sandy, and rocky, and, therefore, that it should be light, strong, simple, and with as few wearing parts to collect sand and grit as possible. It will be well for any man who taps a pipe under pressure for the first time to choose, if he can, a section which can be easily shut off, for it will be nothing strange if he has to shut down and take off the machine to get the cock into the pipe. Printed directions for operating are furnished with each machine, and a week's work will make one independent of them.

That which is screwed, soldered, or driven into the main pipe is the corporation cock; at the sidewalk we have the curb or sidewalk cock, and just inside the cellar wall should be placed the house shut-off, or stop and waste cock.

In the early days of the Boston Water-Works sidewalk cocks were not used, and to shut off the premises wholly from the main the Water Department was obliged to dig

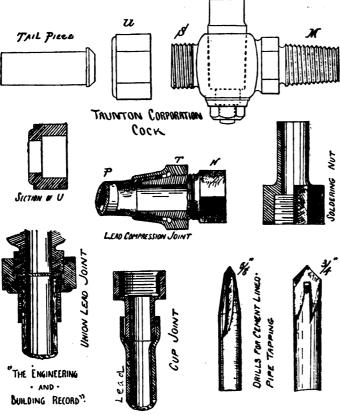


FIGURE 20.

wrought-iron pipe with some protecting coating. Tinlined lead pipe is not, to the writer's way of thinking, worthy of much consideration. The tin lining is thin and easily broken in working, and if the lead be exposed at any point the chance for some galvanic action, followed by the formation of lead carbonate or lead oxide, is too great to be taken. If any combination of chemical and physical reasons in some special case should render lead pipe unadvisable, a perfect though expensive substitute may be found in pure block-tin pipe.

The experience of every city and town which uses lead for service-pipe is, so far as I can learn, that a thin brownish insoluble coating soon forms on the interior walls of the pipe, and then all further action ceases. The cities of New York, Philadelphia and Boston; Worcester, New Bedford, Fall River, in Mass.; Denver, Col.; Atlanta, Geo.; Chicago, Ill.; Wilmington, N. C., to go no further in this country, and Glasgow and Manchester abroad, use lead pipe, and this consideration would seem to dispose of

down to the corporation cock. This condition of things was unsatisfactory, and, under the direction of Assistant Engineer Brackett, sidewalk cocks are being inserted.

As to the house shut-off just inside the cellar wall, there seems to be no good reason why the Water Department, or the water company, should furnish that, except to secure uniformity and a first-class fixture. That there should be a good, sound, easy working shut-off cock at that point there is no sort of doubt, but who should furnish it may be left as an open question. In Taunton it is furnished by the consumer.

Referring to Fig. 20, which represents the particular pattern of corporation cock, with full 3/4-inch way, designed by the writer for use upon the Taunton Water-Works, the end M is the end which is screwed into the main. The general form of this end is the same no matter what is used for service pipe. Something is saved in the cost of manufacture by using the same thread at S and M. Eleven, twelve, fourteen, or sixteen threads to

the inch are admissible, but fourteen has been found to give good results in the practice of the writer. At the end S and in the parts immediately following there is room for great variation in form and method. With the nut u (shown also in section) and the tail-piece forming a ground union joint at the end S, this form of cock may be used (1), with lead service-pipe by making a wiped joint or a cup-joint between the lead pipe and the tail-piece; or (2), with any kind of wrought-iron service-pipe by joining on to the tail-piece a short piece of lead pipe, perhaps 18 inches, just as if the service were to be of lead pipe, and then, by attaching a soldering nut, as shown, and continuing the line with screw-joint pipe.

There is a form of corporation cock in the market in which the end S has a female connection so that wrought-iron pipe may be screwed directly to the cock without the intervention of lead pipe, but this form cannot be recommended for general use, because the flexibility of lead pipe is needed to insure safety against overstraining from settlement in the trench.

In addition to the joints made with lead pipe by wiping or cupping, there is one which may be called the compression-joint. Some regard this joint as to be preferred to any joint which depends upon solder, but the writer's experience does not lead him to take this view of it.

The compression-joint was in use a few years ago in Taunton, but was abandoned for a cup-joint. The corporation-cock then in use was shaped at the end S like the projecting part of N in the compression-joint shown in Fig. 20, and tightness was secured by scraping the outside of the lead pipe to a reasonably smooth surface, so that the cone-shaped nut would draw the lead pipe firmly over the conical projection; the lead pipe having been first spread by driving in a solid plug.

It is evident that this principle can be applied in a variety of ways, and that castings can be designed to fix any combination of materials. For example, the cup joint in Fig. 20 shows how a wrought-iron service-pipe may be joined to a lead connection from the corporation-cock. The lead pipe is attached by a wiped or cup joint to the soldering nut, which is tapped out to receive any size of wrought iron or brass pipe that one chooses.

Still another form of joint has been brought to my attention, by Mr. J. G. Briggs, Superintendent of Water-Works at Terre Haute, Ind., and shown also in Fig. 20, as a union lead joint. Mr. Briggs says the idea is not a new one, but was used twenty years ago or more by an English company who did a large amount of work at Rio Janeiro, Brazil, and that in San Francisco the joint has been used for sixteen years with good results. The lead pipe is put through the brass thimble, and the end hammered or riveted over on a pin made for the purpose, and tightness secured by a washer. If this washer be of lead it will last, but it would seem as though a leather or a rubber washer would be too short-lived to be wholly satisfactory. As to the merits of this joint the writer has no practical knowledge, but the fact that Mr. Briggs favors it would, in the vernacular of the stock market, be counted as a "bull point" for it.

(To be continued.)

FLASH-SIGNALING ON THE CLOUDS.

In the *Electrician* of December 2 is described an experiment on cloud signaling at Singapore between two vessels of the British Navy some sixty miles from each other. Flashes of varying duration and interval forming the letters of the alphabet according to the Morse system were thrown upon the clouds by an electric light. The message was received correctly, but the reply was not intelligible. Though the experiment was only partially successful, it suggests important possibilities, although obviously limited by the necessity of favorable atmospheric conditions, a dark night and low clouds being essential. It is really a sort of artificial "heat lightning."

M. Ducretet has made an important improvement in this method of signaling by an apparatus which automatically records the signals that have been given.

We believe that by means of the heliotrope the Morse signals can be flashed by reflected sunlight to an equal or greater distance from one mountain peak to another, and that this method has frequently been used by our army officers in their Indian campaigns, and also to give "sights" in trigonometrical surveys.



HOT-WATER HEATING APPARATUS IN A SMALL BRICK HOUSE IN BROOKLYN.

THE following communication from "Thermus," describing a piece of work, will be found of interest:

SIR: I herein describe an experimental hot-water apparatus fitted in the most simple manner in one of the numerous small brick houses intended for one family now being built in New York and vicinity. These are now a feature of immense districts of Brooklyn, N. Y. These houses rent from \$300 to \$450 a year, according to circumstances and location, and are the homes of many thousands of small business men, professional men, and clerks who do business in New York and vicinity, and who thus have accommodations in pretty brick or brownstone-front houses, all to themselves, who would be forced to live in apartment-houses in New York at greatly advanced rents.

The drawback to these houses, however, is their method of heating. They are, almost without exception, warmed (?) with a fire-place heater in the dining-room, with a flue to the parlor and front bedroom. During the cold weather people are either forced to freeze or be suffocated with the nondescript half-furnace, half-stove that warms the dining-room and sends gas, ashes, and dust to the upper floors, as not one in twenty of these fire-place heaters are in order during the second winter, and whether they are in order or not the houses cannot be warmed by them in ordinary cold weather. Such, however, is the writer's experience with two different ones, and it seems to be the experience of his neighbors. If much air is allowed to go upstairs from the heater in the dining-room, the draught along the dining-room floor towards the heater keeps one cold. No air is admitted from out of doors, so the advantage of fresh air cannot be claimed for them; they depend on the return of the air down the stairways for a supply to keep up the circulation.

Almost invariably, however, the leakage of gas is from the heater into the air-flues of the house. A 3-inch smokepipe is run up within the principal air-flue, and when the air-flue draws better than the chimney and smoke-pipe the inhabitants keep warm on a mixture of warm air and coalgas, especially when the damper in the pipe is shut, which is the invariable rule at night, to save coal, by those who follow the instructions of the makers. Fortunately, this 3-inch damper has a 1-inch hole in its centre "to carry off the gas," and, therefore, people do not die suddenly from coal-gas poisoning, but of the impairment of health from this cause there is no doubt in the judgment of any intelligent person who has investigated it.

To escape this state of affairs the writer put up the apparatus shown here, and is now using it the second winter with a satisfaction that is beyond comparison. There is no patent on it and its cost is trifling, which will be given in detail hereafter. The radiators and boiler used by the writer are, presumably, patented by the maker, but as any hot-water boiler of the half-dozen good ones now before the public can be used, and flat coils of 1-inch pipe or any hot-water radiator can be placed in the rooms, it comes to the same thing; as the principle of piping is old and is the property of any one who wishes to use it.

In this case a No. 22 Hitchings hot-water base-burning boiler was used and placed in the corner of the dining-room at B. It looks like a base-burning stove and takes up no more room. The object of the position was two-fold. It warmed the dining-room and brought the boiler very near the basement door so ashes, etc., could be quickly removed to the area under stoop, the usual receptacle for it in these houses. The only objection to this position is the length of the stove-pipe as the houses are now built. In the summer, however, this is taken away, and in the winter (with all the heat that comes from a fire in a hot water boiler) a Russia iron pipe five inches in diameter is not very objectionable. In fact, to the man who had to wear his overcoat at breaktast when he depended on his Baltimore heater it is most welcome.

From this little boiler, that has about fifteen square feet of fire surface in it, there is carried a 1½-inch flow-pipe to within six inches of the ceiling. Just below the elbow there is taken the flow or supply pipe for the parlor radiator, plainly shown in the diagram, Fig. 1, which diagram is an exact reproduction of every bit of pipe in the house, and, to a practical man, shows all there is to be seen. For the unpractical, however, I will explain further. After supplying radiator No. 1, the 1½-inch main passes into the hall, or just through the partition. From there it is carried straight to the rear wall of house, through the basement

hall and kitchen, reducing to 1¼ inches in size after the !hird heater is taken off, and thence carried 1¼ inches to the end or fourth heater. This main rises all the way to the last heater, there being about 3 inches rise in its whole length. The return-pipe is an exact reproduction of the flow-pipe, and is set side by side with it, the only difference being in where it enters the boiler—at the bottom. The radiators are all of the same size with an angle-valve to the inlet end of each. They are nominally 25 square feet of surface each, being single-row Bundy hot-water loops, regular height, 10 long, taken at 3½ square feet of the loop, making, in all four, 140 square feet of surface, which has proved itself ample to warm the house when taken in addition with the mains and boiler.

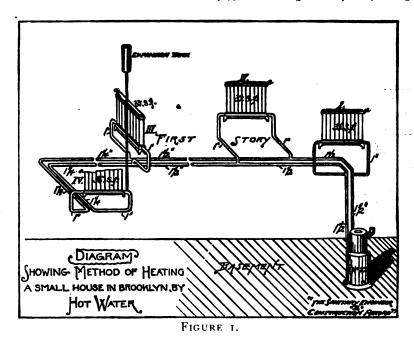
The upper or bedroom floor requires no heaters. Sufficient heat escapes from the parlor floor to keep it warm.

A difference of about twelve degrees exist, between the temperature of the flow and return pipe between where the one flows out of the boiler and the other enters it.

The cost of such an apparatus is as follows:

The boiler, or one of equal power, can be purchased	
and delivered for about	\$50
140 square feet of good hot-water radiator will cost	
about 40 cents per square foot	56
The cost of mains is about \$16	16
Four days' labor, man and helper, \$7.50	30
Smoke-pipe and zinc	5
One thermometer on flow-pipe at boiler	3
Galvanized sheet-iron expansion tank and sundries	5
	\$165

This is the actual cost, and does not allow for profit for a pipe-fitter. If, however, the consumer takes the builder's risk and contracts for labor, he can keep his cost down to \$175, unless things are very badly managed. THERMUS.



DOWNER METHOD OF HEATING A SMALL HOUSE IN BROCKLYN BY HOT WATER

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In the coldest weather, with water at 170° Fah., the windows on the upper floors can be kept open an inch or two, and, ordinarily, a temperature of 150° Fah. in the pipes keeps the house warm and comfortable, and allows for opening the windows, as above, for a change of air. The apparrtus runs day and night, and a varation of ten degrees is never experienced.

The average consumption of hard coal is less than 50 pounds per day; a ton a month more than doing for all purposes. With the old heater a ton would last not quite twenty days for all purposes.

The houses are in blocks, thirty such houses being in the block this one is in. The end houses would require a more ample apparatus, as they have more windows and a greater outside wall area; for the centre ones, however, the apparatus described here is ample.

The sizes of windows are marked on the plans, Fig. 2, and also the sizes of the rooms.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Mctropolitan Gas-Light Company.	Mutual Gas-Light Company	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
December 31	23.88	18.49	2I 34	29.89	28.39	25.64	31.54

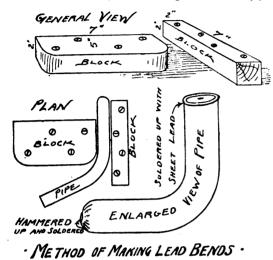
THE EXPLOSION AT THE EQUITABLE GASWORKS.

THE cause of this disaster, which occurred on New Year's eve and has been fully described in the daily press, has not yet been satisfactorily ascertained, but the dynamite theory at first advanced has been entirely abandoned.



REGARDING THE MAKING OF LEAD BENDS. MILWAUKEE, WIS., December 27, 1887.

SIR: As winter approaches, notwithstanding the jokes of the daily press, the plumbers do not feel exuberant over the prospect of a fortune to be made by thawing and repairing bursted water-pipes. One way to keep the men out of mischief in the long winter days is to make lead bends. The days of "hand-made" traps are over, but as a great many 11/2 and 2 inch lead bends are used by plumbers, it would be profitable to make them. Make a block of wood 2 inches thick, 7 inches long, and 5 inches wide, in this shape, and screw it to the bench. On the right of this piece, and 21/2 inches away, screw on a piece of block 2 inches thick, 7 inches long, and 2 inches wide. Now take a piece of 1½ or 2 inch light lead waste-pipe,



and plug it tightly at one end with a wooden plug, fill it with hot sand, and plug the other end the same way. Some plumbers dress one end in and solder up the point, and after filling the pipe with hot sand, they solder a piece of sheet-lead across the other end, and leave a small air-hole in the centre, which is soldered up the last thing.

The length of the piece of waste-pipe is immaterial, but two feet long is the easiest to handle.

Heat the part to be bent over the blast-furnace so that it is nearly ready to melt and place it between the two blocks. Then bend it around the curve of the block and by using a dresser a perfect bend can be made.

The bends can be made up for overflows to baths and basins and kept in stock. The bends we buy cost us from 40 to 50 cents each, and a good plumber can earn his wages in the winter days making these bends. It is worth a trial at all events. W. G. NICHOLSON.

MASTER PLUMBERS' ASSOCIATION OF BOSTON.

BOSTON, January 2, 1888.

THE meetings of the Master Plumbers' Association are now held on the second and fourth Thursdays of the month, at Elks' Hall, No. 24 Haywood Place. Yours truly,

FRANK A. TITUS, Corresponding Secretary.

PHILADELPHIA TRADE SCHOOLS.

(Special Correspondence.)

PHILADELPHIA, January 3, 1888.

THE Trade School Committee of the Master Plumbers' Association of Philadelphia have determined to open the school connected with the association on January to, for a term of three months, and have prepared a circular of which the following are extracts:

The Trade School under the auspices of the Master Plumbers' Association of the city of Philadelphia will be opened for the season on January 10, 1858. There will be instruction two evenings each week; on Tuesdays, drawing; Fridays, shop practice.

The shop practice will consist of:

- (1) Copper-bit work, tinning of metals.
- (2) Making straight joints.
- (3) Branch-joints.
- (4) Upright joints.
- (5) 2, 3, and 4 inch round and flange joints.
- (6) Cup-joints and seams on sheet-lead.
- (7) Lining tank (copper and lead).
- (8) Making service-boxes and lead traps.
- (9) Calking or making joints on iron pipe.

(10) Rigging hydrants.

Blackboard illustrations of the manner of setting and fitting up plumbing fixtures.

Mental exercises in the nature of questions and answers on :

- (1) The proper arrangement of drains, soil, and waste pipes.
- (2) Trapping and ventilating of drains, soil, and waste pipes.

(3) Cold-water supply-pipes.

The lessons in drawing will consist of instruction in the elements of drawing adapted to the forms of various size of pipes, bends, branches, Y's, T's, etc., as applied to the plumbing of private and public buildings with a view to obtaining proper and effective drainage, showing the principles of syphonage, a proper understanding of which is essential.

Improperly arranged plumbing plans will be given the class for correction in order that they may understand the subject.

Only employees of members of the Master Plumbers' Association will be admitted as pupils. The charges for instruction, including the tools and materials, will be \$3 per term of three months, and applicants must have certificate of appplication signed by their employer.

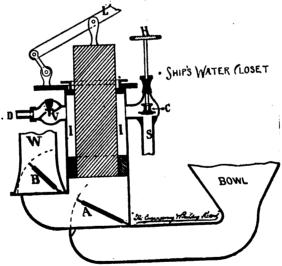
OPERATION OF A SHIP'S WATER-CLOSET DISCHARGING BELOW WATER-LINE.

SIR: Will you explain the working of water-closets which on ships are often situated below the water-line? And oblige,

REPLYING to inquiry of method of arranging waterclosets on ship-board below water-line, we give a working diagram of a closet manufactured by A. B. Sands, of this city, intended for use on yachts, pilot-boats, etc., either above or below the water-line.

Whenever used, the piston is operated by the handlever L. The down stroke creates suction in upper part of chamber I I, closes the valve V, and draws water through 34-inch supply pipe S.

At the up stroke of the piston, valve C closes and valve V opens, and the water in the chamber is forced through discharge-pipe D, which carries it around and flushes the bowl.



At the same time suction is created in the lower part of chamber II, closes valve B, opens A, and draws the soil into the lower part of the chamber. The next down stroke repeats the flushing operation, closes valve A, opens B, and forces the soil up the pipe W and thus discharges it into the sea below the water-line. Repeated strokes will be required to discharge W if its outlet is much above the closet.

The top of chamber I I, bottom of piston, and valve-

rod H are well packed.

C is simply an adjustable check valve to control supply of flush-water, the proper regulation of which greatly facilitates the easy working of the closet, and for this reason the piston is made so large as to greatly reduce the annular space between it and the walls of the chamber.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

RAPID TRANSIT IN NEW YORK.

SIR: Referring to the communication from an engineer incorporated into your editorial of December 24,

Rapid-Transit Problem in New York," in which he says "one has only to use the London underground," I wish to suggest that the discomforts of the London underground may be no arguments against a New York underground, any more than the fact that on roads costing over \$200,000 per mile in England, a passenger does not ride with the comfort attained on a \$15,000 to \$20 000 road in this country, and pays more for his ride, unless he rides third class, is an argument against our railioads.

There they warm (?) their cars with a hot-water instru-

ment of torture, which makes you wish to put your feet out of the window for coolness during the first hour of your journey and wrap them up in any heat-retaining rug to keep them from freezing for the last hour. And they stop their trains to collect fares! and get run into for their

These are the most costly roads in the world, which are supposed to be the best. They exact between two and three cents per ten mile for freight, and though their engines cost a little more in the first place and quite as much for repairs, they pay less wages by nearly one-half than we, who collected only a fraction over one cent per ton mile on all the freight carried in the United States during 1886.

We may have as inconvenient, costly and bad-smelling an underground railroad in this city as they have in London. Yet I will believe it when I see it.

Please allow me to submit, even though you are advo-cating a road through the blocks on solid masonry, that cating a road through the blocks on solid masonry, that while a road is built for the convenience of its patrons, the people who build it look for interest on the capital invested. This consideration should never be absent from the mind of the engineer entrusted with the design and execution of the work, unless it is a work which, like the smoking of a cigar, is not expected to add to the world's utility. The chattering arrangement now standing in the Sixth and other avenues of this city was cheap enough—to the directors—to probably afford an ample compensation from fares at three cents each. But no one, except those who wish for the profits of building, wish to see any more such structures, and the choice seems to lie between the plans you have advocated and an seems to lie between the plans you have advocated and an Arcade or underground road.

No one can doubt that a solidly built road through the blocks would be more pleasant to ride on than one under Broadway, but the last would carry as many passengers, and probably leave half of the capital required for the better road, free to enter other enterprises; hence, an arcade road through Broadway, which did not have to buy its right of way, could carry passengers cheaper than a road built through the blocks, though it might happen that the only difference would be that the capital invested in the one would earn more than that invested in the

[Passenger carrying capacity is not the only consideration.—ED.]

CAST-IRON PIPES USED FOR MAIN SEWERING AND HOUSE-DRAINING.

LONDON, December 15, 1887.

SIR: The question has been put to me by some of your municipal engineers as to my opinions of the probable endurance of cast-iron pipes when used as sewers and drains. My answer in brief is that "I do not know," as, though I have an experience of thirty years, the pipes used by me are as sound now, apparently, as the day when they were first laid down.

The conditions to be observed are: A full and perfect coating of the cast-iron pipes, when fresh from the foundry, with the black varnish patented by the late Dr. Robert Angus Smith. Let the varnishing be done at the proper time, in the proper manner, and with the proper varnish, and the endurance will most certainly be far beyond my experience. I have seen pipes taken up which had been in the ground thirty years and the varnished skin of the pipe was clean as on the day it was laid. This was the external portion. The inner portion of a pipe may be incrusted by deposit, and if acids are turned in from brass foundries, tin-works, and zinc-works, the pipes may be injured, but I have not as yet seen pipes so injured.

R. RAWLINSON.

SIR ROBERT RAWLINSON ON SMALL PIPE SEWER SYSTEMS.

New York, January 1, 1888.

SIR: I have recently received a very kind letter from Sir Robert Rawlinson. In it he volunteers his opinion on a number of points in connection with sewerage. Thinking that it might also be interesting to your readers, I quote the following. RUDOLPH HERING.

"No drain from any house should be less than six inches in diameter. No sewer in a street should be less than nine inches. All junctions of sewers with the main should be entered at the level of the top rather than at the invert, so that the entering sewers and drains shall not be back-watered by the flow in the main. It is more difficult safely to sewer and drain steep gradients than flat gradi-



ents, because sewage-gases will flow upwards as sewage gravitates downward, and the upper part of a town will be flooded by sewage-gases from below. All steep gradients should be broken by ramps, having special means for ventilation, and the upper ends of all steep sewers should have full ventilation equal to the diameter of the sewer."

"Sewers and drains should be so constructed as to unceasingly pass fresh sewage out without leaving deposit. The most sluggish flow should not be less than one mile per hour, and with sewers true in line, in form, in grade, and well flushed, this may be accomplished, especially if subsoil water is taken in to a limited extent. The worst sewer to manage is one laid on a dry subsoil of sand or gravel, and the sewer leaking. In such sewers deposit will be found. Every dry sewer-trench should therefore be made water-tight before the sewer is laid in, or the sewer will be foul."

"I have sewered towns in England having from 10,000 to 40,000 inhabitants where the entire population is supplied with water-closets, and there is a flow of subsoilwater in the sewers. Every particle of human excreta is at the outlet within the day, the flow from 12 o'clock at night to 6 o'clock in the morning being clean water."

"P. S.—With the end of this year—after 40 years—I end my Government service."

ON THE LOCATION OF TRAP VENT-PIPES. New York, January 4, 1888.

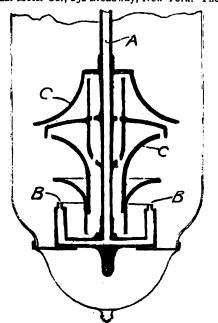
SIR: In reference to the question of location of a ventpipe on trap, as brought up by correspondence in a recent
issue of THE ENGINEERING AND BUILDING RECORD—
viz.: as to whether vent is proper on crown of trap or some
six inches beyond, more or less, as the different situations
call for—my belief is, the proper place is on crown of
trap. I have heard it said that there was an objection to
this, owing to the water splashing up in said vent, and
through time stopping up from grease, etc., that may be
carried by said splashing, thereby spoiling the purpose it
was supposed to remedy. However, that has not been my
experience; on the contrary, I have always found the said
vents perfectly open and as clean almost as when put in.
I think it is a benefit to the trap-seal where such action
takes place, as some of the water thrown up naturally falls
back into trap and filling same, as intended it should be.
There may be cases where the waste may become stopped,
said stoppage back into vent, waste cleaned, and vent left
stopped. I have recently made some tests in this matter
on private houses I fitted up four vears ago and constantly
occupied. I have not found a stoppage in any of them.
Respectfully, JOHN RENEHAN.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any ofter of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

MEAD'S REGENERATIVE GAS-LAMP.

THE following is an illustration of a new gas-lamp about to be jut on the market by the manufacturers, the National Meter Co., 252 Broadway, New York. The prin-



ciple of its construction, it will be noticed, is that the gas descends the centre tube, A, and igniting at the holes

B, the light is reflected from the enameled surface of the cone or regenerative chamber C. Some of the products of combustion pass into the regenerative chamber, and are returned to the inner side of the flame, securing a more thorough combustion of the gas. Air is admitted to the inside of the flame through passages not shown in the cut. It is claimed that in tests where less than seventeen feet of gas per hour was burned, a steadier and stronger light was secured than from a six-burner chandelier.

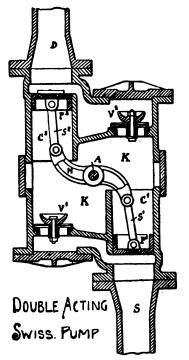


The illustration shows a view of one design. The pulls are for turning on or shutting off the gas.

NOVEL DOUBLE-ACTING PUMP.

Two Swiss inventors, Messrs. Buss and Muller, have contrived a double-acting pump with a single pair of valves.

The illustration, which, with the description, is taken from *Chronique Industrielle*, shows the two cylinders, C¹



and C^9 , open at both ends and connected, through the central chamber K, with the suction and discharge pipes S and D by the valves V^1 and V^9 respectively. The rock-

ing-shaft A controls the pistons P^1 and P^2 by the beam H and links S^1 and S^3 .

In their movement the two pistons simultaneously increase or diminish the volume of chamber K. In the first case the suction-valve V¹ opens and admits into K a quantity of water equal to the sum of the volumes of the two cylinders, while, at the same time, the piston P² forces half that volume into the discharge-pipe, and the piston P¹ displaces a like amount into the suction-pipe, so that only half the quantity has to be drawn in. On the reverse stroke the two pistons approach each other and discharge through valve V² a volume of water equal to the diminution of the chamber K, but the receding of piston P² permits only half of that volume to be forced through the discharge-pipe, while the receding of piston P¹ draws the same volume into the suction-pipe as before.

Thus the valves work alternately, and the pistons also each on its up-stroke only, causing a continuous and uniform flow both in the suction and the discharge pipes.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING of the society was held on Wednesday evening, January 4, the President, William E. Worthen in the chair. The paper of the evening was "The North River Bridge Problem, with a Discussion on Long-Span Bridges," read by Mr. Gustav Lindenthal, M. Am. Soc. C. E., of Pittsburg, Pa. The writer outlined a gigantic scheme for constructing a suspension bridge across the Hudson River for the purpose of bringing all the great railroad lines into New York City somewhere above Fourteenth Street. The proposed bridge is to be of the suspension type, and will have two steel towers, located on either shore inside of the pier lines, which will be 500 feet in height. There will be three spans. The length of the central one will be 2,850 feet from centre to centre of towers, and the length of spans between the towers and anchorages are each to be 1,500 feet.

The anchorage must necessarily be very large, the dimensions being 210 wide by 320 feet long, and 210 feet in height.

The roadway is to be 86 feet in width, and will accommodate six tracks.

The longest single span designed up to the present day is for the Forth Bridge now being constructed in Scotland.

After going into the details of his plan to some extent, the writer gave a short description of the different elements of construction and typical constructive details of floor systems and wind cables, followed by a discussion of the cantilever and arch type of bridges, and temperature strains in iron bridges.

The writer advocated the building of a bridge in preference to a tunnel, and stated that a bridge with six tracks would accommodate all of the railroads desiring to enter this city and could be constructed at a smaller cost than the number of tunnels that would be required to furnish the same accommodation, and this cost could be estimated with more certainty.

A bridge built according to this plan would furnish transportation facilities for 50,000 passengers per hour in one direction, probably sufficient to meet the demands for fifty years to come.

The estimated cost for constructing the bridge alone, including the piers and anchorages, would not exceed \$15,000,000, exclusive of land damages.

A discussion of this interesting paper will follow at a future meeting of the society, and further particulars, with illustrations showing how this proposed structure compares with the great bridges of the world, will appear in our next issue.

The following candidates were declared elected:

As Members.—Channing Moore Bolton, Chief Engineer Richmond and Danville Railroad and Manager Richmond City Street Railway, Washington, D. C.; De Clermont Dunlap, Division Engineer, Kansas City Extension C. M. & St. P. Ry., Chicago, Ill.; Henry Holbrook Gladding, engaged chiefly on sewerage, New Haven Conn.; Arthur Hawiland (elected Junior January 4, 1882), Sanitary Engineer and Assistant City Engineer, San Antonio, Tex.; Camille Stanislaus d'Invilliers, engineer in charge of surveys and construction Tyrone Division Pennsylvania Railroad in Clearfield coal region, Phillips burg, Pa.; Charles Hees Ledlie, Civil Engineer, St. Louis, Mo.; Henry Benjamin Patten, Division Engineer Wyoming Division Union Pacific Railway, Cheyenne, Wyo.; Frederick John Henry Rickon, City Engineer, Little Rock, Ark.; John Munrhad Stewaith Assistant Engineer New Croton Aqueduct, Pobbs Ferry, N. Y.; George Francis Wright, City Surveyor, Santa Barbara, Cal.

As funiors.—Julius Le Roy Adams, engaged on construction Williams' Bridge Reservor, Brooklyn, N. Y.; Francis Henry Bainbridge, Assistant Engineer Edge Moor Iron Co., Wilmington, Del.; Eugene Carroll, Resident Engineer Covington Transfer Ra.lway, Covington



Ky : Russell Wadsworth Hildreth, with Union Bridge Co. on the Willamette River Bridge for Oregon Railway and Navigation Co. residence, New York City; Alexander Edward Kastl, Transitman Atchison, Topeka and Santa Fe Pailroad, Chicago, Ill.; William Anthony Lydon, Assistant Engineer with Drainage and Water-Supply Comm ssion, Chicago, Ill.; Alexander Potter, Assistant in office of Chief Engineer Chicago, Santa Fe and California Railway, Kan-

THE ENGINEERS' CLUB OF PHILADELPHIA.

THE Secretary is very glad to be able to announce to the members that both members and guests seem to have been much pleased with our decennial reception, held December 17, 1887. It is almost impossible, we find, to exactly determine the number present, but it looks very much like 342. We were not, however, overcrowded, and judging from the fragments that remained, everybody had enough to eat, ----, and smoke. There was no speechmaking or any attempt to introduce any feature which might have deprived the affair of an entirely informal and purely sociable character. It is believed that this entertainment will be of substantial and permanent benefit to HOWARD MURPHY,

Secretary and Treasurer

THE STRENGTH OF A BALCONY WANTED.

ST. PAUL, December 15, 1887.

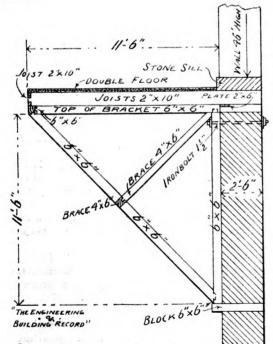
ST. PAUL, December 15, 1887.

SIR: I have made plans for a five-story building for Mr. J. E. Brady, of this city. The building has a porch on the side facing the river, of which I send you a sketch showing the exact construction of the said porch. The building inspector of this city says that a row of men stationed in a line at the extremity of the porch would cause it to break. As I am under the impression that the building inspector is not in the right, I beg you to do the owner of the building and myself a favor by stating in your journal what safe load will the said porch carry and what is its breaking load, and oblige.

The Brady Building Porch.

[The balcony is 45 feet long by 11 feet 6 inches wide, and is supported on four brackets placed 14 feet apart, which, by means of stringers at the outer edge, carry the 2x10-inch floor-beams spaced about 15 inches C to C, and whose inner ends are built into the wall.

Assuming that all the connections are perfect so as to causeno reduction of section and develop the full strength of every part, the following are the safe and breaking loads due to each member, supposing it for the time to be the weakest.



CROSS SECTION OF PORCH SHOWING BRACKET

The details of the connections are not clearly shown, and, as far as indicated, see altogether inadequate. For instance, the connection of the top of the brace to the outer stringer instead of to the horizontal piece called "top of bracket" is an inexcusable blunder, and renders the brace nearly useless, unless it is connected to the "top of bracket" by some means not suggested by the drawing.

On the other hand, the 11/2 inch bolt through the wall is absurdly large and unnecessarily weakens the timber through which it passes, for it can have no greater pull on it than that sustained by the tenon on top of the upright which it holds, which probably could be safely sus-

tained by a bolt not much over half its diameter. In any case the tenon can have no more strain than what may be due to the horizontal outward trust of the top of the brace, which, with the inadequate connection before mentioned, would be very little indeed.

These safe loads, then, have merely a theoretic value and cannot be taken as reliable for this particular structure without further particulars.

The breaking load of the floor-beams alone without the brackets would be 272 pounds per square foot, and the safe load 34 pounds per square foot, supposing that part of the wall resting on them to be heavy enough to keep them from prying it up. This would be true only in case the weight subtracted from the superincumbent wall by openings was balanced by the additional load put upon it by the upper floors, and also in case the wall, which is said to be 20 inches thick, above the balcony were offsetted on the outside only so as to be flush inside.

The inclined struts of the brackets cannot be considered to be properly braced, as there is nothing to prevent them from deflecting simultaneously to the same side, and therefore they would be liable to break at a floor-load of 176 pounds per square foot, and would not be safe for more than 22 pounds per square foot.

The load per square foot that could be safely supported on the balcony by the 11/2-inch bolts is about ten times as much-a ridiculous disproportion.

It must not be assumed that because the floor-beams, as cantilevers without the brackets, would safely carry 34 pounds per square foot, and the brackets alone would safely carry 22 pounds per square foot, that the two together would be safe for 56 pounds per square foot, for the brackets, by reason of their greater stiffness, would take nearly all the load at first and not till they had been crippled, so as to afford little, if any, support, would the cantilever action of the beams come into play.

From the safe loads given above the weight of the structure, which cannot be much less than ten pounds per square foot, must be subtracted to find what can be safely borne, which is very little indeed-hardly, as far as the brackets are concerned, equal to a good fall of snow.

The New York building laws require all dwelling-house floors to be proportioned for a live load of 75 pounds per square foot, and those of public resorts for a live load of 120 pounds per square foot, and nothing is more liable to overcrowding than a balcony in case of any public display or excitement.

As between our correspondent and the building inspector, we think they are both right, for while the inspector would have failed in his duty had he not condemned such a flimsy and ill-proportioned structure, it would probably for a long time have been safe for a single row of men at its outer edge, provided always that the connections were adequate and the wall so heavy and so placed as to hold down the beams.

We have given more consideration to this case than we should otherwise have done, as it is the not infrequent one of a builder anxious to do what is right, but unable, through lack of scientific knowledge, to determine in an unusual case what the right thing is.

We trust it may serve to warn those who may have similar problems that a due regard for the lives and property of their neighbors would require them to take competent professional advice in all matters of which they are not absolutely certain.

In this respect our correspondent has set them a commendable example, though, as a rule, the nearest good engineer is the proper person to whom to apply.]

PROPOSED NEW LIGHT-HOUSE AT CAPE HATTERAS.

RECENT press dispatches state that the Lighthouse Board is considering the feasibility of erecting a lighthouse of the first order on the outer shoals at Cape Hatteras. These waters, which are regarded as the most dangerous on the Atlantic coast, are now insufficiently protected. The engineering difficulties in the way of the construction of a lighthouse on the shoals are so many that the recent developments in constructive engineering were needed to insure success in the undertaking. Plans for the work are now being prepared.

THE Master Builders' Exchange of Philadelphia intend celebrating the first anniversary of their existence by a grand complimentary banquet to its members and many distinguished guests on January 24 at St. George's Hall, when it is expected some 400 persons will be present.

SOUNDING BY MEANS OF TORPEDOES.

A DUBLIN inventor, Mr. J. Joly, has devised a method of expeditiously obtaining soundings from a moving vessel. He drops overboard a torpedo arranged to explode on striking the bottom. The time that elapses in different depths of water between dropping the torpedo and hearing the report of its explosion having been previously ascertained by experiment, the observer, with a stopwatch, which may graduated to depths instead of seconds, and equipped with an ear-trumpet, a telephone dipping into the sea, can readily determine the soundings. For shallow water the ear-trumpet may not be necessary.

LEBANON, PA., WATER-WORKS.

R. J. SHERK, Superintendent of the Water-Works of Lebanon, Pa., reports that the cost of the works was \$252,000, and the debt is \$150,000. The population is now 14,000 and the daily consumption 1,000,000 gallons. There are 23 miles of pipe, with 1,940 taps, 4 meters, and 90 hydrants. The pressure is 60 pounds. The supply is by gravity and a temporary pumping plant.

BUILDING IN MINNEAPOLIS.

THE total amount of building in this city for the past year amounted to \$9,311,372. Nearly 150 business blocks were erected at a cost of \$1,000,000; nearly \$200,000 has been put into churches; the educational institutions erected have cost \$407,000; in manufacturing, \$271,860 has been expended; new grain elevators have cost \$350,000, and \$425,000 has been spent on bridges.

A CORRECTION CORRECTED.

OUR artist was right after all about those hook-bolts illustrated in our last issue. The bolts being used as stated, to secure the cross-ties to the track-stringers, or what en the L-roads are the longitudinal girders, are, of course, used with the hook end down, as shown,

The head of bolt A exactly resembles the clip used with a lag screw for fastening the rails on the L-roads, and misled us for the moment.

RECENT PUBLICATIONS.

MESSRS. CARRERE & HASTINGS, of New York, the architects of the Ponce de Leon and the Alcazar, the notable hotels recently built at St. Augustine, Fla., have issued a very attractive publication in which the advantages of St. Augustine are set forth. Among the beautiful illustrations in this publication are perspectives of these two famous hotels and interior of bits of detail; also of the Casa Monica, of which Mr. F. W. Smith is the architect. Among the illustrations are reproductions of the drawings that are so attractive a feature of the Architectural League of this city.

"THE LOCOMOTIVE ENGINEER."

WE have received the first number of this journal, issued by our friends, the publishers of the American Machinist. The new journal is to be devoted to the "special interests of locomotive engineers and firemen and locomotive maintenance and repairs." In its salutatory it announces that its editor, Mr. John A. Hill, left his locomotive to accept his present position. We wish our new contemporary the fullest measure of success, and it certainly starts out with good prospects, since its promoters have been so successful in establishing so good a paper as our esteemed contemporary, the American Machinist.

THE TEHUANTEPEC SHIP-RAILWAY.

COLONEL JAMES ANDREWS, of Pittsburg, who was Mr. Eads' principal associate in his various undertakings, and has since the death of the latter been really at the head of the Tehuantepec Ship-Railway project, has brought to New York the very complete and valuable model of the shiplifting appliances which Mr. Eads had made when in England four years ago, and is having it set up in the Mills Building preparatory to more active operations in furtherance of this great enterprise.

PERSONAL.

DR. O. W. WIGHT, Health Commissioner of Detroit, Mich., has just returned from his trip around the world.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

CORNING, N. Y.—Plans are wanted for a Y. M. C. A. building to be built in this city.

BRIDGETOWN, N. J.—Plans for a \$30,000 building are wanted by the Y. M. C. A.

MAMARONECK, N. Y.—The Y. M. C. A. wants plans for a new building to cost \$50,-

TRADE CATALOGUES.

MESSRS. FRANCIS MORANDI & SON, of Nos. 50 Union and 37 Friend Streets, Boston, Mass., have just sent us their new catalogue illustrating and describing a variety of ranges, steam-tables, steamers, kettles, urns, copper and iron goods, etc., for restaurants, hotels, etc., manufactured by them.



For works for which proposals are requested see also the "Proposal Column," pages i-v-v111-05.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

WELLAND, CAN. — Our correspondent rites: "By-law has been passed authorizing use of \$32,000 for the erection of water-works, and all arrangements have been made to secure water-power from the Government of the Dominion with Lake Erie for a head, and it is the intention of the corporation to proceed with the construction as soon as spring opens."

MOUNT VERNON, ILL.—Our correspondent writes from here as follows: "The waterworks scheme has fallen through."

READING, PA.—Our correspondent writes: "The Council will ask for proposals for the construction of two large sewers, to cost \$60,ooo, in February.

FORT WAYNE, IND .- The Natural Water-Supply Company, of Cincinnati, offers to furnish Fort Wayne, Ind., an inexhaustible supply of water by a series of filter wells to be put down by a steam process, charging for the system complete \$190,000. The company agrees to furnish 3,000,000 gallons of water per day.

RANTOUL, ILL.—Concerning water-works matters here our correspondent writes as follows: "Our town has in contemplation the nonlows: "Our town has in contemplation the building of small works in that line on the tower and tank plan. Tower about forty feet, tank to hold about 600 barrels. We expect to pump by wind-power for the first year."

HERKIMER, N. Y.—Our correspondent writes: "Our water-works will be a reserve supply and direct pumping system. At this date cannot give full particulars, but will as soon as possible."

COXSACKIE, N. V.—In answer to an inquiry about the reported building of water-works here our correspondent writes: "There has been property bought here for water-works, but when they are to be put in operation no one seems to know. The property was purchased by Mr. Benjamin H. Stevens, Flatbush, L. I. By writing to him you will get the information."

MT. STERLING, KY .- Mr. H. Clay McKee writes from this place as follows: "Some steps have been taken looking towards the construction of water-works for this city. I am one of a committee to look after the matter, but no contracts have yet been made to construct them."

ROCKFORD, ILL.—It is reported that a sew-erage system is to be established here.

LEBANON, PA .- Our correspondent writes: "The city is furnished with water by gravitation at present. There is some talk of making an additional supply by means of pumping, but the city is not in a position financially to warrant the additional debt. In case of a drought we have a temporary pumping of water into the mains for which the city pays \$30 per 1,000,000 gallons of water." The city is furnished with water by gravita-

KANSAS CITY, Mo .- Concerning the building of additional sewers here our correspondent writes as follsws: "Plans are about completed for sewers in two districts, the work for which will be for letting about February 10. The probable cost of both is \$45,000. Further plans and work in a great measure depend upon the construction of the O. K. Creek sewer, delayed by want of money, \$250,000, a large part of which I have hope will be provided from our next tax levy, in May next."

HENDERSONVILLE, S. C .- Our correspondent writes, concerning the water-works, as follows: "The election was held in this town January 2 and resulted in a unanimous vote for water-works. We want to issue bonds soon and let the contract."

SEABRIGHT, N. J .- Concerning water-works matters here our correspondent writes as fol-lows: "Company organized; 2 Hall steampumps, 14x7x12 and 2 boilers; stand-pipe contracted by Cunningham Iron Works, Boston; water supply from bored wells; pumphouse nearly finished; foundation of stand-pipe in progress."

AMERICUS, GA.—Address the Mayor for information of new water-works, reported to be built here.

ROANOKE, VA.-It is reported that the Mayor can give information of a projected sewerage system for this place.

WARRENTON, VA.-It is reported that a New York company has made a proposition to build water-works and erect an electriclight plant here. The Mayor can give infor-

LINDSBURG, KAN.—It is reported that water-works are to be established here.

ACUSHNET, MASS.—Concerning a report that water-works were to be erected here, our correspondent writes: "I know of no waterworks in contemplation here in Acushnet."

BRIDGES.

FALL OF A BRIDGE AT PITTSBURG.

PITTSBURG, PA.—The bridge across the Allegheny River at Thirtieth Street, that city, fell into the river on Monday morning last, the ice having taken out the false work.

The contract was originally let to D. W. C. Carroll & Co., but, subsequently, it was given to the Keystone Bridge Company, and they had just taken hold of the work and will be the losers.

DAVTONA FLA -Concerning a report that a bridge was to be erected here, our correspondent writes as follows: "There is no spondent writes as follows: There is no public bridge to be built here; there is talk of a bridge over the Halifax River by private parties, but has not taken definite shape as yet. Perhaps will in the near future.

VINCENNES, IND.—A \$32,000 bridge is to be built here across the Wabash. The city officials have charge of the construction details.

JEFFERSONVILLE, IND.—It is reported that a bridge is to be built between this city and Louisville, Ky., to cost about \$1.250,000. It is said that plans are wanted, and that information can be had by addressing the Hon. Jonas G. Howard, Washington, D. C.

GAS AND ELECTRIC-LIGHTING.

TROY, ALA.-It is reported that an electriclight plant is to be erected here.

DE FUNIAK, FLA.—The streets of this place are to be lighted by electricity.

MILWAUKEE .- The residents of the northwestern portion of Milwaukee are complaining because the electric lights contracted for by the city are not placed in position and running.

The contract was let some time ago for 30 electric lights to be in operation by December 15, but the poles are not erected yet.

MOUNT VERNON, N. Y .- This village has entered into a contract with the electric-light company for the latter to furnish 30 street lamps at a cost of \$100 a lamp a year, and with the gas company to furnish 150 street lights at a cost of \$20 a lamp a year.

FREDERICK, IND.—Efforts are being made to establish an electric-light plant here. W. A. Dunn, of Baltimore, is at the head of the

CLEVELAND, TENN.—The Mayor can give information concerning the erection of an electric light plant here.

LEXINGTON, KY.—It is reported that the local gas company will enlarge its works.

HAMPTON, VA.—An electric-light plant is to be established here. For details address James W. Nagley, Pittsburg, Pa.

AMERICUS, GA.—Gas-works will probably be established here. The Mayor can give de-

STREET WORK AND PAVING.

MILWAUKEE.—The Board of Public Works will boulevard Pleasant Street, from Van Buren to Franklin Streets, 5 blocks. The following streets will be repaved: Juneau Avenue, from Milwaukee to Market Streets, 2 blocks; Van Buren, from Knapp Street to Jun-eau Avenue, t block; Knapp Street, from Astor to Franklin Street, I block; Prospect Avenue, from Royal to Lafayette Place, 3 blocks; North Water Street, from Juneau Avenue to Lyon Street, 2 blocks.

RAILROADS, CANALS, ETC.

MILWAUKEE, WIS.—The 1,300-foot tunnel on the Chicago, Madison & N. R. R. Co., three miles north of Monticello, is nearly com-In five weeks the arch supports will be completed and the steel laid through the

The Milwaukee & Lake Geneva R. R. Co. will build 55 miles of track, from Milwaukee to the State line. A large part of the grading has been done.

The contract to build three miles of track at Marion, Iowa, has been let by the Chicago, Milwaukee & St. Paul Railway Co. to Harrisch & Green, of Milwaukee. It will be necessary to remove 100,000 yards of earth to make one cut on this piece of work.

The Wisconsin Central Line will build from Antioch (or near there) on their present main line to Geneva, thence up to Portage by the new route of the Geneva & Portage R. R., thus connecting them with their Southern

Thomas S. King, a New York contractor, has been looking over the old Milwaukee and Beloit Railroad and says it will be rebuilt this summer. He was accompanied by two engineers from Chicago who investigated the feasibility of raising the Central Line's bridge at Mukwonago, Wis. It can be raised six feet and the new road, the Milwaukee Peoria & St. Louis R. R. Co., can pass under the Cen-tral's road. The officers of the new road are tral's road. The officers of the new road are W. F. Dalrymple. President, Milwaukee; George H. Noyes, Secretary and Treasurer, Milwaukee; J. R. Robinson, Chief Engineer, New York.

WEATHERFORD, TEX.—The Weatherford Street Car Company has been organized and will commence building in a short time.

HAMPTON, VA .- James A. Nagley, Pittsburg, Pa., can give information concerning an electric street railway to be built here.

McKenzie, Tenn.-It is said that W. E. Harding can give details of a proposed street railroad for this place.

BIDS OPENED.

ST. PAUL, MINN.—Synopsis of bids for water-gates, opened December 28 by the Board of Water Commissioners: R. D. Wood & Co., Philadelphia, Pa., \$6,645.56; Eddy Valve Co., Waterford, N. Y., \$5,820.50; Coffin Valve Co., Boston, Mass., \$5,905; Whittier Machine Co., Boston, Mass., \$8,121.75; Galvin Brass and Iron Works, Detroit,

Mich., \$5,231.50. The contract will be awarded January 10.

MILWAUKEE, WIS .- The following bics were opened for paving the gutters and graveling the roadway on Seventeenth Avenue, from Orchard to Maple Street, December 30, 1887:

BIDDERS.	Graveling. Per sq. yd.	Paving. Per sq. yd.
Louis Pegler. John Dierschow F. Hildebrand, Jr. Adolph Weidner. Matthew Heiden. Julius Duehnike Loreiz Seymor. Henry Vogt.	63 58 58	50c. 42 43 ¹ / ₄ 42 43 *30 ¹ / ₄ 50 43

* The contract was let to Henry Vogt at 37c. for the graveling, and to Julius Duehmke at 36%c. for the paving.

ST. PAUL, MINN.—Synopsis of bids for 5,000 tons cast-iron water-pipe, in sizes from 4 to 36 inches, opened December 29 by the Board of Water Commissioners: R. D. Wood & Co., Philadelphia, Pa., \$163,063.62; D. Long & Co., Louisville, Ky., \$158,390.80; the Addyston Pipe & Steel Co., Newport, Ky., \$163,076; Lake Shore Foundry, Cleveland, O., \$159,719.90; Shickle, Harrison & Howard Iron Co., St. Louis, Mo., \$153,673.20; the McNeal Pipe & Foundry Co., Burlington, N. J., \$181,132.07. The contract was awarded to the lowest bidders. St. Paul, Minn.—Synopsis of bids for

NEW YORK CITY, N. Y.--The following bids were opened January 4 by the Department of Charities and Correction for furnishing two steam-boilers at Central Islip, Long Island, N. Y. Bidders: P. Carraher, Jr., \$2,397; James Moore, \$1,995; S. Reid, \$1,690

For steam heating for one pavilion on Randall's Island. Bidders: P. Carraher, Jr.,

\$2,797.
For furnishing one duplex steam pump at Central Islip, Long Island, N. Y. Bidders: P. Carraher, Jr., \$1.479; George B. Blake Manufacturing Co., \$723; Hall Steam-Pump

For constructing three pavilions, a diningroor constructing three pavinons, a uningroom and kitchen, an administration building, a storehouse and a stable and wagon-house, at Central Islip, Long Island, N. Y. Bidders: J. H. Brady, \$33,443; William S. Velsor, \$31,000; James Moore, \$35,975; Thomas Lyons, \$47,000.

For constructing a water-tower and tank residence, engine and boiler-house, at Central Islip, Long Island, N. Y. Bidders: James Moore, \$6,533; Thomas Lyons, \$7,500; J. H. Brady, \$5,986; William S. Velsor, \$7,800.

NEW YORK CITY.-The contract for the construction of the gate-house and superstructure at South Yonkers on Section 9 of the Aqueduct has been let to O'Brien & Clark at \$20,935.

BUFFALO, N. Y.-C. K. Summerhays has received the contract for steam-fitting and apparatus for the Lewis Building, at \$6,000, and Home for Young Girls, at \$3,000.

INDIANAPOLIS, IND.—C. K. Summerhays, of Buffalo, N. Y., has received the contract for steam-heating of the residence of M. Mil-

ST. PAUL.-Contracts awarded by the Water ST. PAUL.—Contracts awarded by the Water Board for 5,000 tons of pipe, both for high and low service, for Merriam Park and for West St. Paul, awarded to the Shickle, Harrison & Howard Iron Company, of St. Louis, for \$155,500. Bids for valves were opened and laid over until the next meeting of the board, to be held January 10. The contract for stop-cock boxes and valve-boxes was awarded to A. W. Morgan, of Buffalo, for \$3,143.50. The contract for brass goods was awarded to the Thomas & Wentworth Manufacturing Company, of Milwaukee, for \$1,520.

MINNEAPOLIS, MINN.-E. T. Sykes has Bids were: Porter Steam-Heating Company, \$1,650; Hantun Steam-Heating Company, \$1,590; F. F. Martin, \$1,344; E. T. Sykes & Co., \$1,340.



NEW ORLEANS. LA.—Synopsis of bids for NEW URLEANS, LA.—Synopsis of bids for furnishing a quantity of 12 inch cast-iron pipe, opened December 30 by W. I., Fisk, ('aptain of Engineers, U. S. A., Lighthouse Engineer: Woodward, Wight & Co., New Orleans, La., \$44 per ton; James H. Aitken & Co., New Orleans, La., \$40.

BROOKLYN, N. Y.—The following proposals were opened December 29 and announced for furnishing gas or other illuminating material for street lamps and public buildings in the city of Brooklyn for the year buildings in the city of Brooklyn for the year 1888, to wit: People's Gas-Light Company, per lamp, \$22 per year; lighting public buildings, per 1,000 cubic feet, \$1.60; Nassau Gas-Light Company, per lamp, \$22 per year; lighting public buildings, per 1,000 cubic feet, \$1.60; Metropolitan Gas-Light Company, per lamp, \$22 per year; lighting public buildings. \$1.00; Metropolitan Gas-Light Company, per lamp, \$22 per year; lighting public buildings, per 1,000 cubic feet, \$1.60; Williamsburg Gas-Light Company, per lamp, \$21.75 per year; lighting public buildings, per 1,000 cubic feet, \$1.60; Citizens' Gas-Light Company, per lamp, \$22 per year; lighting public buildings, per 1,000 cubic feet, \$1.60; Brooklyn Gas-Light Company, per lamp, \$19.80 per year; lighting public buildings, per 1,000 cubic feet, \$1.50; Citizens' Electric Illuminating Company, per light, \$182.50 per year: ing Company, per light, \$182.50 per year; Municipal Electric-Light Company, per light, \$182.50 per year.

GOVERNMENT WORK.

SAN ANTONIO TEX -Synonsis of bids for stone and brick-work for basement and walls of Court-House, opened December 30 by the Supervising Architect of the Treasury Department:

Price per cubic foot for for Additional stone.	16.4488.00 Granite, \$t. 27 16.424.91 Granite, \$t. 27 14.24.00 Bedford, 2.37 16.25.00 St. 00.1.1.35 9.372.00 Granite, \$2.50 16.000.00 Granite, \$2.50 17.300.00 Granite, \$3.05 17.300.00 Granite, \$3.05 17.300.00 Granite, \$3.05 17.300.00 Granite, \$3.05 17.300.00 Granite, \$3.05 17.300.00 Granite, \$3.05 17.300.00 Granite, \$3.05 12.880.00 Granite, \$3.00 12.880.00 Granite, \$3
Amount.	\$4.488.00 \\ \text{Line 14.48} \text{Circle 15.44.9} \\ \text{Line 14.42.0} \\ \text{Circle 16.44.9} \\ \text{Line 14.42.0} \\ \text{Circle 16.00.0} \\ Circle 16.00.
BIDDFRS.	F. H. Mickle, John and G. Kleindienst. Jobst Eros, Bedford and Granite D. C. Anderson Dumeanel & Co., Granite Bourne and Richard Sione Pauley & Dirlmann George W. Lars, No. 1 Keliey Bros, & Co. Pauley & Dirlmann George W. Corbet McC. & Baldwin

JEFFERSON CITY, Mo.-Synopsis of bids JEFFERSON CITY, MO.—Synopsis of bids for steam-heating and ventilating apparatus for the Court-House and Post-Office, opened December 29 by the Supervising Architect of the Treasury Department: Samuel I. Pope & Co., Chicago, \$7.690; William Kirkup & Sons, Cincinnati, O., \$8,700; Kunze & Barker, Milwaukee, \$7,993.

WASHINGTON, D. C.—Synopsis of bids for improvement in plumbing, U. S. Treasury Department, opened January 3 by the Supervising Architect of the Treasury:

Samuel H. Sherwood, \$15,000; for vent. \$40.

John McDougal, \$12,701.29; for vent., \$30. James T. Bruce, \$12.350; for vent., \$75. Delaney & Talbott, \$7,463; for vent., \$70. Lowest hid

William Rothwell, \$9,800; for vent., \$48. R. G. Campbell, \$9,045; for vent., \$100. John Mitchell, \$10,600; for vent., \$125.

MISCELLANEOUS.

MILWAUKEE.—A \$40,000 fire-tug will be purchased by the city of Milwaukee to protect river property.

The sum of \$20,000 will be expended in improvements in the Seventh Ward as follows:
Repaving Van Buren Street from Wisconsin
to Biddle Streets (three blocks).

Repaving Oneida Street from East Water Street to alley near Broadway (one and a half New pavement cedar blocks from alley on Oneida Street to Broadway (half block).

Paving Broadway with cedar blocks from Johnson to Mason Streets (four blocks). Paving Johnson Street one block from Broadway to East Water Street.

A top dressing of broken granite on Milwaukee, Van Buren, and Biddle Streets (about ten blocks) on macadamized streets.

Paving alleys in blocks 53 and 101.

MILWAUKEE, WIS.—The Hinsey Cable Railroad ordinance has passed the Council and been signed by the Mayor and has become a law. They will use the Rasmussen system and will run on Milwaukee Street from Michigan Street, on Oneida Street, Wells, Seventh, State, to city limits, and a branch on corner State and Eighteenth, to run on Eighteenth Street to city limits on the north.

LIVINGSTON, MONT.—San Francisco capitalists will put in smelting works. Certificates of incorporation for a railroad to run from Livingston to Castle Mountain were filed in the office of Territorial Secretary Webb. Governor Hauser is at the head of the enterprise and the smelting-works. Both are assured facts, to be commenced as soon as the weather will permit

NEW CORPORATIONS.

THE Amsterdam, N. Y., Arc Light Co.; capital stock, \$15,000. J. O. Hirschfelder and others, incorporators.

THE Mahoning Gas Fuel Company, Youngstown, O., capital increased from \$500,000 to \$750,000.

THE Gas and Electric Light Company, of York, Neb.; capital, \$8,000. M. Soverign and others, incorporators.

THE Hallett Electrical Illuminating and Power Company, Kansas City, Mo.; capital, \$60,000. A. L. Ellis and others.

THE Mount Carmel, Ind., Natural Gas and Improvement Company; capital, \$10,000. J. Johnston and others.

THE Pacific Railway Company of Nebraska The racine Ranway Company of Archassa: The capital stock is \$6,600,000. The proposed railway begins at a point on the south line of Hall County, and runs in a north-westerly direction to the west line of Nebraska, with the right to construct branch lines to other places within the limits of the State. The road is believed to be an extension of the Hastings branch of the Missouri Pacific.

THE DRS Moines and North-western Railway Company, Des Moines, Iowa. Capital stock, \$4,000,000. G. M. Dodge, and others, incorporators.

THE Ohio Valley Railway and Terminal Company, Evansville, Ind. Capital stock, \$300,000. Charles Yeile, and others, incor-

THE Allegheny and Kinzua Railroad Company, Olean, N. Y. Capital stock, \$80,000. Charles G. Freck, and others, incorporators.

THE Wichita, Richfield and Trinidad Railroad Company, Richfield, Kan. Capital stock, \$4,000,000. F. F. Stevens, and others, incorporators.

THE Sault Ste. Marie Railway Company, Sault Ste. Marie, Mich. Capital stock, \$100,-000. W. Chandler, and others, incorporators.

THE City Electric Street Railroad Company, Little Rock, Ark. Capital stock, \$200,000. Howard B. Adams, and others, incorporators.

THE Nashville and Charleston Railway Company. Nashville, Tenn. Adolph Montandon, and others, incorporators.

THE Chicago, Hinsdale and Southern Railroad Company, Chicago, Ill. Capital stock, \$500,000. David A. Courter, and others, in-\$500,000. corporators.

THE Kansas, Nebraska and Decatur Railroad Company, Claffin, Neb. Capital stock, \$3,000,000. Arthur W. Dole, and others, incorporators.

THE Citizens' Electric-Lighting and Power Company, at Kensington, Ill. Incorporators, C. B. Sawyers, C. E. Godfrey, and others.

THE Steel Car-Wheel Company organized at Portland, Me., with a capital stock of \$300 000. The stockholders are: S. Allen Freeman, Winthrop, Mass.; Nathan Washburn, and others.

PROPOSALS.

(Continued from page viii.)

SEALED PROPOSALS will be received at the office of the Supervising Architect of the U. S. Trasury Department at Washington, D. C., and opened at 2 r. M. of the 26th day of January, 18.8, for plumbing work and gas-piping tor the Court-House, Post-Office, etc., building at Dallas, Texas. Each proposal must be accompanied by a certified check for \$200, made payable to the order of the Treasurer of the United States. The right to reject any bids is reserved. The plans and specification can be had at this office, the office of the Superintendent, and at the offices of the secretaries of the following-named associations: Mechanics' Exchanges, Boston, Mass., St. Louis, Mo., and New Orleans, La.; Builders' Exchanges, Philadelphia, Pa., and Ci cinnati, Ohio; Permanent Fxhibit and Fxchange, Chicago, Ih.; and North-Western Permanent Fxhibit, Minneapolis, Minn. (Signed) WILL. A. FRERET, Supervising Architect. 5TH OF JANUARY, 1888.

WATER WORKS.—Proposals are wanted at St. eter, Minn., until March I, for building a complete stem of water works. Address C. R. Davis, City

BRICK BLOCK.—Proposals are wanted at Chattanonga, Fenn., until lanuary 14, for erecting a block of brick buildings. Address Divine, Vaudry & Co.

ELECTRIC-LIGHT PLANT. - Proposals a wanted at Hagerstown, Md., for putting in an electlight plant. No date specified. Address M. Funkhouser.

SEWER PIANS.—Proposals will be received by the Committee of the Board of Trustees of the village of New Rochelle, N. Y., until January 16, 1288, for making survey, drawing plans and specifications for a system of sewers for said village.

Further information can be had by applying to the committee. Address John Sheehan, of the commit-

CHURCH.—Proposals are wanted at Branchville, Ala, until January 16, for the erection of a church. Address T. M. Haygood.

STREET WORK.—Proposals are wanted at Brook-lyn, N. Y., until January 18, for doing work in certain streets. Address George Ricard Conner, Commis-sioner of the Department of City Works.

REPAIRING BRIDGE .- Proposals are wanted at Brooklyn, N. Y., until lanuary 18, for repairing the turning gear of Hamilton Avenue bridge. Address George Ricard Connor, Commissioner of the Department of City Works.

WATER-PIPE — Proposals are wanted at Nashville, Tenn., until January 10, for furnishing 1,150 feet of 8-inch and 1,150 feet of 6-inch cast-iron water-pipe. Address George Reyer, Superintendent of Water-Works.

DOCK-WORK.—Proposals are wanted at New York OUCK-WORK.—Proposals are wanted at New York City until January 16, for removing the existing pier at the foot of West Thirty-eighth Street, and for pre-paring for and building a new wooden pier and approach at the foot of said street, and for repairing the existing crib-bulkhead thereat. Address the Department of Docks, Pier 1, North River.

MOVING BUILDINGS.—Proposa's are wanted at San Francisco, Cal., until January to, for moving several buildings at Fort Winfield Scott, Cal., and also repairing. Address J. S. Oyster, 1st Lieutenant and Q. M. 1st Art., A. A. M., U. S. A.

CAST IRON PIPE, FITTINGS, etc.—Proposals are wanted at Baltimore, Md., until January 9, for furnishing several tons of cast 'ron pipe, fittings, brass stops, etc., according to specifications. Address Robert K. Martin, Chief Engineer Water Department.

FOUNDATIONS,—Proposals are wanted at Washington, D. C., until January 30, for furnishing and putting in place, complete, the timber pile foundations of the Court-House, Post-Office building, etc., at Key West, Fla. Address Thomas D. Fister, Acting Supervising Architect.

ELECTRIC LIGHT AND GAS FIXTURES.—Proposals are wanted at Washington, D.C., until Janug, for placing in position, in complete working order, in the Custom House Building, at Toledo, Ohio, certain electric light and gas fixtures. Address C. S. Fairchild, Secretary Treasury Department.

BROKEN STONE, ETC.—Proposals are wanted at Washington, D. C., until January 23, for furnishing broken stone, cement, sand, fire-bricks, or granite. Address James Fulton, Paymaster General, U. S. Navy.

DOCKING AND CALKING. — Proposals are wanted at Philadelphia, Fa., until January 12, for docking and calking Lightship No. 45. Address John J. Read, Commander, U. S. Navy, Light-House In

IRON CASTINGS.—Proposals are wanted at Char-leston, S. C., until January 9, for furnishing Street Department with iron castings for year 1888. Address the Committee on Streets.

STRFET-WORK.—Proposals are wanted at New York City until January 11, for street-work. Address Department of Publ c Works.

WATER-PIPE, CASTINGS, ETC.—Proposals are wanted at Franklin, Ohio, until January 18, for furnishing water-pipe, castings, etc., according to specifications. Address William Michael, of the Board of Water-Works Trustees.

SCH DOL.—Proposals are wanted at Gaine's Station, Mich., until January o, for electing a blick school house. Address School Building Committee, Gaine's Station, Mich.

WATER-WORKS SUPPLIES. — Proposals are wanted at Mount Morr's, N. Y., until January 20, for furnishing cast-iron pipe, hydrants, boilers, engine, and pump, according to specification. Address George W. Phelps, Mount Morris, N. Y.

PROPOSALS.

WATER-WORKS.—Proposals are wanted at Dallas, Tex., until January 11, for constructing, etc., trustorage and subsiding reservoirs, according to specifications. Address W. E. Parry, City Secretary.

SEWERS.—Proposals are wanted at Williamson, a., until January 18, for the construction, etc., of twers in certain streets. Address R. H. Farts, City

WATER-WORKS.—Proposals are wanted at Washington. O., until January 9, for the construction of a complete system of water-works. Address H. L. Hadley, of the Water-Works Committee.

PROPOSALS for the work and material to be furnished in enlarging the drill-hall of the State Armory in Brooklyn, N. Y., and providing a fence around the said armory grounds, will be received, util January 13, 1888, at the Stiete Arseral, Thirty-fifth Street and Seventh Avenue, New York City. Plans and specia cations may be seen at the office of architect Engage F. Caylor, 66 Broadway, Brooklyn, N. Y. Proposals must be addressed to the undersigned Commissioners Josiah Poter, Adjutant General; Fml Schaefer, Inspector General; J. M. Varian, Chief of Ordnance Commissioners.

SCHOOL.—Proposals are wanted at Gloucester. Mass., until January 25, for erecting high-school building. Address John J. Somes, Clerk of Building Committee.

COURT-HOUSE.—All the contracts for erreing the court-house in Liberty, Mo., have been rejected, and new bids are wanted.

TANK AND GAS-HOLPER. — Proposals are wanted at Philacelphia, Pa., until January 9, for the construction of a tank and gas-holder. Addres Loss Wagner, Director, Bureau of Gas, No. 20 South Seventh Street.

GAS WORKS.—Proposals are wanted at Tem-kana, Tex., until January 14, for constructing ga-works, with five miles of mains. Address W. I. Whitaker.

SCHOOL BUILDINGS,-Proposals are wanted at Columbus, O., until January 19, for the construction of three school buildings. Address Clerk Board of Education.

STEAM HEATING.—Proposals are wanted at Columbus, O., until January 19, for the Ruttan-Stread system of heating and ventilation for several school buildings. Address Clerk Board of Education.

WATER WORKS.—Proposals are wanted at Mation, Va., for the construction of a complete system of water works. No date specified. Address J. H. Francis, Recorder, Town of Marion, Va.

BRICK CHURCH.—Proposals are wanted at Wrandotte, Mich., until January 16, for building a boxt church for the Evangelical Lutheran Trinity contragation. Address G. C. Bernethal, Secretary of Building Committee.

SEWFRS.—Proposals are wanted at Jersey City, N. I., until January 16, for constructing sewers it certain streets. Address Martin Finck, Clerk Board of Public Works.

BUILDING.—Proposals are wanted at Chilicothe, Mo., until February 2, for doing work, etc., in the construction of the building for the State Industrial Home for Girls. Address William McIlwaib. Chairman of Board.

PUBLICATIONS RECEIVED.

THE ANNUAL RFPORT made to the Urban Satisfary Authority of the Borough of Huddersfield for the year 1886. By J. Spottiswoode Cameron, M. D., B. Sc. Edin., etc., Medical Officer of Health to the Borough, Medical Officer to the Birkly Fever Hospital, Honorary Physician to the Huddersfield Infirmary, etc. Printed by order of the Sanitary Committee, 8vo., 63 pp., paper. Huddersfield: George Whitehead & Sois.

THE CIVIL ENGINEER'S FIELD BOOK. Designed for the use of the locating engineer. Containing tables of actival temperature and arresported HE CIVIL ENGINFER'S FIFID BOOK. Designed for the use of the locating engineer. Containing tables of actual tangents and arcsexpressed in chords of too feet for every minute of interaction, from 0° to 90°, from a 1° curve to a 10° curve inclusive. Also tables of formulæ applicable to railroad curves and the location of frogs, together with long chords, grades, natural tangents, natural sines, natural versed sines, natural extendiscentification, etc., with explanatory problems. By Fdward Butts, Civil Engineer. 16 mo., 269 pp. New York: John Wiley & Sons, 1886.

TME MACHINERY OF SMALL BOATS FOR SHIPS OF WAR, ETC. A paper read at the Twenty-eighth Session of the Institution of British Naval Architects. By A. Spyer, Esq. Member. 10½ xz, 18 pp., paper. Published for gratitous distribution by Frederick M. Wheeler, M. E. 93 Liberty Street, New York.

93 Liberty Street, New York.

STANARDS OF LENGTH AND THEIR PRACTICAL APPLICATION. A resume covered the methods employed for the production of standard gauges to insure uniformity and interchange ability in every department of manufacture. Including the reports of Professor William A. Rogers, the Committee on Standards and Gauges, American Society of Mechanical Engineers; the Committee of the Master Car-Builders' Association, and including also the report of the special committee appointed by the Frankin Instruct, April 1864. Edited by George M. Bond, M. E. 19 mo. 180 pp. Published by The Pratt & Whitney Company, Hartford, Conn.

UNADILLA WATER-WORKS MEMORANDA By Samuel S. North. 27 mo., 16 pp., paper.

THE KALENDAR, 1887-88, of the Royal Institute of British Architects, Fifty-third Session. 8 vo. 156 pp., paper.



- THE VOSBURG TUNNFL: A description of its construction. Illustrated. 11½x8½, 56 pp., paper. Published, with the permission of the Lehigh Valley Railroad Company, by Leo Von Rosenberg, 35 Broadway, New York.
- ANNUAL REPORT of the Missouri River Commission, together with appendices A and B, for the fiscal year ending June 30, 1886. Illustrated. 8vo., 355 pp., paper. Washington: Government Printing Office. 1887.
- THE STEAM-ENGINE CATECHISM. Part I. A series of direct practical answers to direct practical questions, mainly intended for young engineers and for examination questions. By Robert Grimshaw, M. E. Fith and enlarged edition. Illustrated. 18mo., 194 pp. Price, \$1. New York: John Wiley & Sons.
- RECENT ADVANCES in Electricity, Electric Lighting, Magnetism, Telegraphy, Telephony, etc., inluding articles by Editor of Electrician, of London, Professor Thompson, of London, and Professor Edison. Edited by Henry Green. Illustrated. Price, \$2. 8vo., 55 pp., paper.
- REPORT ON THE CAPACITY of the Sudbury River and Lake Cochituate Water-Sheds in Time of Drought. By Desimond Fitzgerald, Resi-dent Engineer, etc. 8vo., 6r pp., paper. Boston: Rockwell & Churchill.

Building Intelligence.

- WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

 ABBREVIATIONS.—\$\delta\$ s, brown stone; \$\delta\$r, brick store; \$\delta\$s dwell, brown-stone dwelling; \$\delta\$part houses, apart nent-house: \$\delta s\$, tenement; \$\delta\$, each \$\delta\$, owner; \$\delta\$, architect; \$\delta\$, builder; \$fr\$, frame.

NEW YORK.

- 123 Baxter, br ten; cost, \$23,000; o, A & C Ruff; a, Schneider & Herter.
- 56th, s. s., 375 e 10th av, two brick tens with stores; cost, each, \$20,000; o and b, John Sheridan; a, A Spence.
- Av B, s e cor 83d, 3 br tens and stores; cost, corner, \$18,000; others, \$11,000 each; o, L & J Brandt; a, J Brandt.
- 80th, s s. 100 w Av A, 9 br and stone tens; est. each. \$12,000; o, James Higgins; a, A B Ogden & Son.
- 83d, s s, 156 e 1st av, two stone tens; cost, each, \$28,000; o, Louis Lochman; a, E Wenz.
- 79th, s s, 100 w 9th av, two br and stone dwells; cost, each. \$35,000; o, Samuel Colcord; a, H L Harris.
- Ws West End av, 88th to 89th sts, 10 br dwells; cost, \$19,000 all; o, Bernard Wilson; a, Thomas Wilson.
- S s 126th, 135 w 3d av, brick stable; cost, \$25,000; o, John Baunen; a, George W Walgrove.
- 438 Pearl, br storage; cost, \$20,000; o, est of J H McGarr; a, Stephen D Hatch.

BUILDING INTELLIGENCE.

253-259 W 32d, 4 br dwells; cost, \$16,000 all; o, Wm Rankin; a, Keister & Wallis.

ALTERATIONS-NEW YORK.

134-136 E 41st, br dwell; cost, \$8,000; o, Benj Lewis; a, H N Holmes.

BROOKLYN.

- Hendricks, s w cor Arlington av, three fr dwells; cost, total, \$12,000; o, a and b, James
- Luquer, n s, 160 e Court, br ten; cost, \$10,500; o, a and b, John J Cody.
- 26 Chapel, br dwell; cost, \$8,000; o, Jas O'Connor; a, J G Glover.
- Es Ross st, 166 s Wythe av, br stable and dwell; cost, \$14,000; o, Von Glahm Bros; a, Rich Von Lehan.
- N w cor Magnolia st and Central av, 2 fr dwells; cost, \$8,400 all; o, A Todebush and A Fuhrman; a, B Finkenseiper.

 W s Tillary, 100 n Washington, br stable; cost, \$15,000; o, H & L Leibman; a, Parfitt Bros

MISCELLANEOUS.

- DETROIT, MICH.—State, br factory; cost, \$22,000; o, C Witbeck; a, G W Lloyd; b, A Chapoton.
 - Park pl, br school; cost, \$12,000; o, St Aloysius' Parish; a and b, same as above. Russell, br factory; cost. \$7,000; o, Art Store Co; a, A Bloquitte; b, J Vandergyp.
- BOSTON.-Off South st, Jamaica Plain, wooden parochial school; cost, \$40,000; o, Right Rev J J Williams; a, P Ford.
- Head place, brick electric station; cost, \$25,000; o, Edison Company; a. Bradley, Winslow & Wetherell.
- 63-65 Essex, br mercantile; cost, \$48.000; o, Alpheus Hardy; a, Cummings & Sears.
- ALMA, KAN.—A \$50,000 court house will be built here. Messrs. Schrage & Nichols, architects, of Kansas City, have made the plans and have charge of the details of con-
- SAN DIEGO, CAL.—A wharf, to cost \$33,-000, is to be built by Herr Wagner.
- CLINTON, MO .- The Y. M. C. A. will erect a \$50,000 building.
- READING, PA.—Penn and 5th, 5-story br bldg; cost, \$11,000; o, F G Bone; b, H. Rummel.
- Penn st and 6th st, br bldg with s trimmings; cost, \$9,500; o, Penn Trust Co., H Kendall, Secretary.
- SOMERVILLE, MASS .- The Masons will erect a \$30,000 structure here.

BUILDING INTELLIGENCE.

- MONTCLAIR, N. J.-The Montclair Club will build a house to cost \$25,000.
- OSHKOSH, WIS .- The Y. M. C. A. will expend \$25,000 in a new edifice
- ALBANY, N. Y .- Mayor Thatcher can give details of the new edifice to be erected by the Y. M. C. A., to cost \$50,000. It is to be 124x130 and fire proof. So far there has been no architect selected.
- PROVIDENCE, R. I.—Canal st fr refrigerator; o, G F and E C Swift; a, Stone, Carpenter & Willson; b, H J Bassett.
- WORCESTER, MASS.—Cedar, fr dwell; cost, \$9,000: o, J D Washburn; a, F Dabney, Jr., of Boston; b, J B Crosby.
- WILLIAMSPORT, PA.—401 w 3d st, br st and dwell; cost, \$12,000; o, Peter Herdic; a, E Culver; b, D P Guise.
- KANSAS CITY, MO.—Cor Harrison and 9th, s and br church; cost, \$80,000; o, Calvary Baptist Society.
 - Thirty-two minor bldgs costing in aggre-
 - None costing \$7,000 or over.
- BALTIMORE, MD .-- N w cor North and Lex sts, 5-story br warehouse; o, Herman D Umbsteter.
- ITHACA, N. Y.—A \$40,000 building is to be erected by the Y M C A of Cornell Col-
- PADUCAH, KY.—A \$20,000 Presbyterian Church will be erected here.
- PITTSBURG, PA.—For particulars about a \$60,000 Episcopal Church address Rueben Miller, of East Liberty, a suburb of this city.
- GOSHEN, IND .- Address the Committee on City Hall for details of new \$30,000 struct-ture.
- DANVILLE, N. Y .- Mr W W Carlin, architect, of Buffalo, has prepared plans for an addition to the Danville Sanitarium, to cost \$25,000.
- CHARLESTON, S. C.—Cor Magazine and Franklin, 3 story br jail, with iron and steel cages and hot-air furnace for heating; cost, \$50,000; o, Charleston County; a, Abraham & Seyle; b, Oliver & Carter, contractors for jail building; Van Dorn Iron Work Co., contractors for iron and steel cages.
- ST. PAUL, MINN.—Nothing over \$7,000 in value to report this week.

BUILDING INTELLIGENCE.

- SOUTH NORWALK, CONN.—A Congregational church to cost \$50,000 will be built
- ROME, N. Y.—The Central New York Institute for Deaf Mutes will expend \$40,-000 in a new edifice here
- JAMESTOWN, PA.—A library building to cost \$75,000 is to be erected here. Address Mrs A T Prendergast.
- WALNUT CITY, KAN.—A \$25,000 court house is to be erected here
- OMAHA, NEB.—Address the Ballau Bros. for particulars of the \$1,000,000 hotel which they are to build here
- LYNCHBURG, VA.—A colored Baptist College is to be erected here, to cost \$30,-
- GALVESTON, TEX. Address architect Geo E Dickey for details of Bayland Orphan's Home
- GENEVA, N. Y.—No building over \$7,000 in value to report this week
- ST. LOUIS, MO.—11 permits valued under \$7,000 each have been issued this week
- CHICAGO. ILL —623-31 Blue Island av, br st and flats; cost, \$35,000; o, Wm Kaspar; a, W H Drake; D, J Warker & Sons
- 48-60 N Clinton, 6-story br warehouse; cost. \$75,000; o, E W Blatchford: a, F H Walscher; b, Ross & Winkler
- 108 Sherman, br st and flats; cost, \$10,-000: o, E J Lehman; a, E R Krouse; b, Agnew & Cox
- 11-15 Fulton, br addn; cost, \$8,000; o, Eckhart & Swan; a, S V Shipman; b, Barney & Rodatz
- 12 bldgs costing less than \$7,000 each
- MILWAUKEE.-E s Astor st, between Martin st and Juneau av, new stone church; cost, \$100,000; o, Immanuel Presbyterian Church; a, E T Mix & Co
- S w cor South Water and Virginia sts, br toundry; cost, \$10,000; o, Rundle, Spence
- A building permit was issued to William Forrestal permitting him to place machinery and buildings on Dane Place to sink a shaft for the flushing tunnel
- Cor 3d av and Park st, br church; cost, \$10,000; o, Asbury M E Church
- Cor Dover st and Kinnickinnic av, brick church; cost. \$10,000; o, St Lucas Evan Lutheran Church; a, H P Schnetzky

Sent (post paid) on receipt of \$2.00.

THE FOLLOWING PUBLICATION IS NOW READY AND FOR SALE.

TITLE PAGE.

A COLLECTION OF DIAGRAMS

Representing the General Plan of

TWENTY-SIX DIFFERENT WATER-WORKS,

Contributed by Members of the

New England Water-Works Association,

And Compiled by a Committee.

1887.

NEW YORK:

PUBLISHED BY THE ENGINEERING AND BUILDING RECORD, 82 & 84 FULTON STREET.

INTRODUCTION.

OFFICE OF SECRETARY,

- New Bedford, Mass., November 1, 1887. .
- NEW BEDFORD, MASS., November 1, 1887.

 THIS collection of diagrams is the result of the persistent efforts of Messrs. Wiiliam B. Sherman, of Providence, R. I., and Walter H. Richards, of New London, Conn., who, as a Committee on Exchange of Sketches, have secured these drawings from members of the Association. The following extract from a report presented by these gentlemen at the Manchester, N. H., meeting in June, 1887, will explain in part the origin of the collection:

 "In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three
- "In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three water-works represented in the Association. Having this data on hand, though crude in many particulars, it was decided to put the same into available shape for the benefit of the members. This has been accomplished by the Committee without cost to the Association. From these rough sketches—revised, reduced to uniform size of 10 by 15 inches—a set of tracings has been made, and a sample tolio of blue prints prepared. This folio and set of tracings are herewith presented as forming the main part of this report."

 Since the Manchester meeting three more subjects have been received and subscribtions for sets of reproductions from the tracings have been called for. The ready response to the call
- tracings have been called for. The ready response to the call is evidence of the value of the Committee's work, and arrangements were made with THE ENGINEERING AND BUILDING RECORD for publication in this present form.

 R. C. P. COGGESHALL,

Secretary, New England Water-Works Association.

Address, BOOK DEPARTMENT,

INDEX.

I.—Boston, Mass.
II.—Burlington, Vt.
III.—Cambridge, Mass.
IV.—Fall River, Mass.
V.—Fitchburg, Mass.
VI.—Knoxville, Tenn.

VII.-Lawrence, Mass.

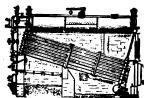
VII.—Lawrence, Mass.
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IX.—Meriden, Conn.
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XII.-Nantucket, Mass. XIII.—Nantucket, Mass.
XIII.—Natick, Mass.
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XVI.—New Orleans, La. XVII.—Pawtucket, R. I. XVIII.—Plymouth, Mass. XIX.—Quincy, Mass. XX.—Spencer, Mass. XXI.—Springfield, Mass. XXII.—Taunton, Mass. XXII.—Waterbury, Conn. XXIV.—Wilmington, N. C. XXV.—Woonsocket, R. I. XXVI.—Worcester, Mass.

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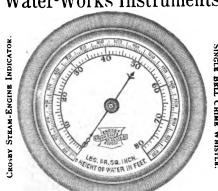
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HOTEL AND RESTAURANT FURNISHINGS.

PONCE DE LEON AND CASA MONICA.

THE fact that the entire kitchen furnishings for Florida's palace hotel, the Fonce de Leon of St. Augustine, were supplied by a Boston house, that of FRANCIS MORANDI & SON, 50 Union Street, rather tickles the pride of proud old Puritanical Boston. That the Messrs. Morandi were able to successfully compete with other leading firms of New York and the West and secure an order of such magnitude, is something that bonifaces throughout the country cannot afford to overlook, when either furnishing new or returnishing an old hotel. The order from the Ponced Leon comprised 20 tons of goods. This firm is now engaged in fitting up the Casa Monica at St. Augustine.

THE SIXTEENTH VOLUME

THE ENGINEERING AND BUILDING RECORD

THE SANITARY ENGINEER.

(June 4, 1887—November 26, 1887.)

Aside from the weekly record of events of special interest to Engineers, Architects, Municipal Officers, Mechanics, and Contractors, the following of the numerous special articles are mentioned as of permanent interest.

Full-Page Architectural Illustrations:

Waste-weir outlet of the Kangra Tank, Ahmedabad,

India.

A mantel in the Tiffany House, designed by Louis C.
Tiffany.
Staircase, Examination Schools, Oxford, Eng., T.
G. Jackson, architect.
Denver Club House, Denver, Col., Varian & Sterner.

Metropolitan Club, Washington, D. C., Gray &

Metropolitan Club, Washington, D. C., Gray & Page, archit ets.
New Dormitory, McCormick Theological Seminary, Chicago, A. Page Brown, architect.
Y. M. C. A. Building and Turner Building, Newburg, N. Y., McKim, Mead & White, architects Hail in Mrs. Bent's House at Longwood, Mass., E. A. P. Newcomb, architect
The Quadrangle of the New University Building, Edinburg, R. Rowand Anderson, LL.D., architect.

Edinburg, R. Rowand Anderson, EL.D., architect.
Residence of Mr. C. W. Norton at Alston, Mass..
Haitwell & Richardson, architects.
Hanan & Son's Shoe Factory, New York, Babb.
Cook & Willard, architects.
Hall in the Tiffany House, New York, McKim,
Mead & White, architects.
Lumber Exchange at Minneapolis, Minn., Long &
Kees, architects.
Residence of William Edgar, Newport, R. I.,
McKim, Meal & White, architects.
A House in Camden, N. J., Wilson Eyre, architect.

tect.
A Manufacturing Building, H. R. Marshall, archi-

ict. Hotel D'Almy, Bloise, France. A Residence in M Street, Washington. An Old Colonial House at Jamaica Plains. Mass. Residence of W. D. Sloane, Lenox, Mass., Peabody Stearns, architects. A Hall in E. W. Anthony's House, E. A. P. New-

A Hall in E. W. Anthony's House, E. A. P. Newcomb, architects.
Interior of St. Etienne du Mont, Paris.
Hotel Pourtales, Paris, France.
Thornwall Orphanage, Clinton, S. C., A. Page Brown, architect.
Residence of Mrs. Cowden, Far Rockaway, McKim, Mead & White, architects.
College of Physicians and Surgeons, W. Wheeler Smith, architect.
Besi des twenty-one Vignette Illustrations, and several drawings of details to scale.

ARTICLES OF SPECIAL INTEREST TO ARCHITECTS:

Result of Cincinnati Architectural Competitions.
Regarding the Study of Architecture; turther letters on this subject.

Description of the Children's Hospital at Walnut Hill, Cincinnati. (Three Illustrations.)
Building Construction Details—Balloon Frames. (Two Illustrations.)
Naurical Arena, Paris (description).
The Hastings, St. Leonard's, and East Sussex Hospolis (descriptions and plans). (Three Illustrations.)
Architecture of London Streets.
Bath-House of Hospital at St. Antoine, Paris. (Two Illustrations.)
Ready-Made Specifications (a criticism).
Fall of an Elevator in a New York Dry-Goods House. (Illustrated.)
Description of the Methodist General Hospital, Brooklyn. (Two Illustrations.)
Trussed Roof over a Drill-Shed at Bury, England. (One Illustration.)
Paris Ordinance Concerning Theatres.
Mud Architecture in Persia.
Dry Rot in a New York Apartment House, Fourth Avenue and Sixty-Second Street. (One Illustration.)
Grain Elevators (Description, with seven illustrations.)
Gettiysburg Cyclorama Building (details of roof and

tions.)

Gettysburg Cyclorama Building (details of roof and structural iron-work). (One Illustration.)

Paramount Requirements of a Large Opera-House (paper by D. Adler, Chicago).

Among the specially prepared articles in the series of Builders' and Contractors Engineering and Plant

of Builders and Constantion age:
are:
are:
Traveler for erecting Kings County Elevated
Railroad, (Three Illustrations)
Excavating apparatus used on the Tancarville
Canal and Sewer. (Three Illustrations.)
Derrock Foot Block and Sheaves at Shaft 14 on the
New Croton Aqueduct. (Two Illustrations.)
Potomac Flats Dredging Plant. (Four Illustraline)

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Tube Riveting Machine at Forth Bridge. (Two Illustrations.)
Lockwood Dredge used on Cape Cod Ship Canal (Eight Illustrations.)
Lockwood Dredge used on New Croton Aqueduct. (Two Illustrations.)
Recent Water-Works Construction—East Orange and Bloomheld, N. J., Water Companies. (Three Illustrations.) Water-Works at Ware, Mass. (Four Illustrations.) Water-Works at Calais, Me. (Three Illustrations.)
Pavements and Street Railroads—Continuation of this series, in which the question of wood pavements in London is fully discussed.
New Croton Aqueduct. No. XIII. Disc for Measuring Cross-section in Tunnels. (Nine Illustrations.)
Tipple for Dumping Cars on the New Croton Aqueduct. (Six Illustrations.)
Modern Sewage Disposal and Engineering. By E. S. Philbrick, M. Am. Soc. C. E. (Two Illustrated articles.)
Sweetwater Dam and Irrigation Experience in Southern California. (One Illustrations.)
Collapse of 75-Ton Derrick at Brooklyn Navy Yard.
Repair and Maintenance of Roads. By W. H.

Sweetwater Dam and Irrigation: Pepeliate to Southern California. (One Illustration.)
Collapse of 75-Ton Derrick at Brooklyn Navy Yard.
Repair and Maintenance of Roads. By W. H. Wheeler, C. E. Report of the Disposal of Sewage in the City of Worcester, Mass.
Portland Cement Tests at Long Dates.
Receiving and Catch Basins at Waterbury, Conn. (Four Illustrations.)
Testing of Portland Cement for the Harbor Works at Calais and Boulogne. By F. Guillair.
Carrying Water-Mains Across the River at Ekhart, Ind. (Two Illustrations.)
Tubular Subway Under Northumberland Straits. (Two Illustrations.)
Filtration or Subsidence. By J. D. Cook, C. E. Special Report of the Chicago Drainage and Water-Supply Commission.
Driven-Well System as a Source of or Means of Obtaining a Water-Supply.
Recent Sewer Construction. Chiswick Sewage Works. (Three Illustrations.)
Burial of Sewage and Refuse. (Criticism on an Address by Dr. G. V. Poore, of London.)
The Moteno Reservoir at Cape Town, Africa.
Downfall of the Suspension Bridge over the Ostrawitza. (Two Illustrations.)
Some Details of Water-Works Construction. By William R. Billings, C. E. (Four articles of this series, with illustrations, have appeared.)
Accident on the New Croton Aqueduct—Collapse of Bulkhead. (Four Illustrations.)
Preparing Refuse Stone for Concrete. (One Illustrations.)
History of the Development of the Art of Bridge Construction. By Prof. William P. Trowbridge. (Twelve Illustrations.)
Kanawha River Improvement (description, with six Illustrations.)
Armory Roof, Buffalo—Ro-foot combination roof, showing scaffold used in erecting. (Two Illustrations.)
Eads' Last Work—Letter written ten days before his death, giving details of construction regarding

showing scaffold used in erecting. (Two Illustrations.)

Each' Last Work—Letter written ten days before his death, giving details of construction regarding design of his plant. (Three Facsimile Illustrations.)

New Water-Works Tunnel, Chicago—Abstract of specifications. (One Illustration.)

Effect of Temperature upon Structural Iron and Steel—Paper by Joseph Ramsay, Sr.

Description of Water-Tower at Franklin, Mass. (Four Illustrations.)

Cape Cod Ship Canal (Description of Work), Manufacture of Hydrauic Cement from Blast-Furnace Slag. By J. E. Stead.

Wreck of Seneca Falls Stand-Pipe. (Description and Four Illustrations.)

Bursting of Little Falls Reservoir. (Description, Fall of Derrick at the New Court-House, Boston, Mass. (Two Illustrations.)

Fall of an Frecting Crane on the Union Elevated Railroad, Brooklyn, N. Y.

Six Years' Experience with Memphis Sewers; Special Repoit to The Engineering and Builling Record, by Ruddolph Hering, with Editorial Comment.

Remarks ble Meeting of Headings on the New

ent. Remarkable Meeting of Headings on the New

Croton Aqueduct.
Milwauker Double Track Praw Span, Designed by the Edge Moor Iron Co. (Two Double-page Il-lustrations and Description.)

Report of Tests of the Westinghouse Air-Brain at Ridgefield, N. J.

MISCELLANEOUS:

at Ringeneio, N. J.

Altsoellantous:

Micro-organisms in the Atmosphere.

The Need of Hospitals for Contagious Distant, Massachusetts I nivestigation of Water-Supply London Sewage Disposal—discussion of method Wages in Great Britain—table of wages pade the different mechanics.

Plan to Provide Chicago with Sub-cellar, in Triffe with the Sewage Problem (Acidicism.) Death-Rates of Different Classes.

Stable Floor Construction—description of constructive features in notable stables in New York and Boston. (Two Illustrations.)

Peculiar Methods in the Distribution of the New York Croton Aqueduct Reports. (A criticism.) Sanitary Engineering and its Results, is littrated in the City of Dublin—review showing references.)

Pavements from Blast-Furnace Slag. Specific Germs of Typhoid Fever.

Manufacture of Salt near Middleboro.

Luning an Aqueduct with Lead (Arcuell).

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Bath in the Residence of Mr. E. H., Wales. (Or Illustrations.)
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Domestic Engineering—Army Mess Hall a Davids Island. (Four Illustrations.)
Novel Pipe Joints or Couplings for Natural Gr. Plumbing—Hot-Water Circulation from Kuder to Top Floor of Building.
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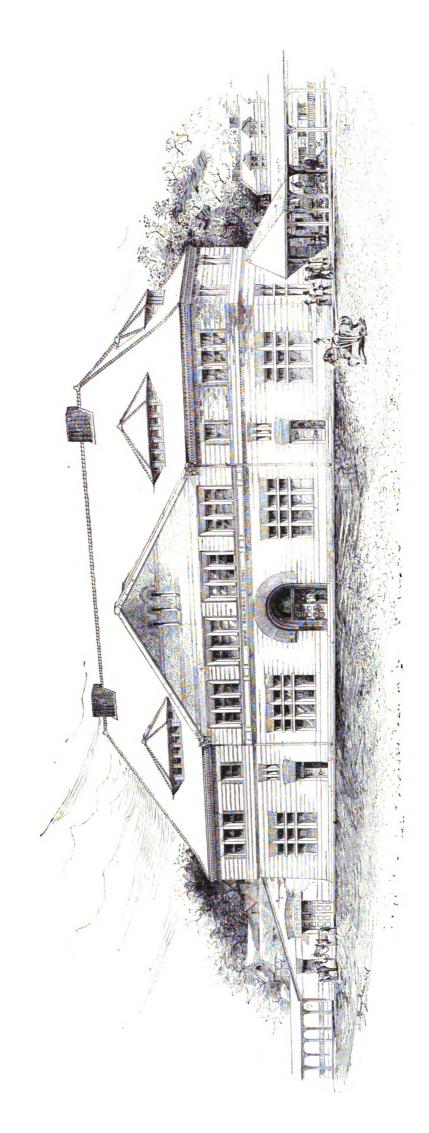
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THE UNION DEPOT, NEW LONDON, CONN.

SHIPLEY, RUTAN & COLRIDGE, ARCHITECTS.

THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE COMMERCIAL ADVANTAGES OF LOCKS AND DAMS FOR THE IMPROVEMENT OF RIVER NAVIGATION ON THE KANAWHA.

THE columns of THE ENGINEERING AND BUILDING RECORD have consistently advocated the improvement of rivers and their conservation, not only as an effective means of reducing the freight charges on railroads in this vicinity, but also because of the great economy resulting from river and canal transportation under reasonably favorable circumstances. These views are very fully borne out by the experience on the Great Kanawha River. In a recent report to Colonel William P. Craighill, U. S. Engineer in charge of the improvements there, made by Mr. Addison M. Scott, Resident Engineer, some exceedingly interesting facts are brought out.

The first locks and dams, Nos. 4 and 5, were

completed in 1880. For the year 1877 there were shipped from the mines by the river something over 5,000,000 bushels of coal, and nearly 8.000.000 by rail. There were then up to 1880 but two small mines above No. 5, shipping about 200,000 bushels per year. Since the completion of these locks the shipments have steadily increased. There are now 18 mines above No. 5, shipping their output by river, and for the year ending June 1, 1887, the shipments by river were over 23,000,000 tons, and by rail 19,000,000 tons.

The rates of towing have also been reduced, owing indirectly to improvements, but directly to the increased competition among tow-boats, the number having doubtless been largely increased as a result of the increase in business to be

The saving in freight over those by rail is very great. The charge for towing 263 miles from Charleston to Cincinnati is 25 cents for 2,000 pounds, or about one-twelfth of a cent per ton mile, and the total additional cost for care of barges, pumping, wharfage, piers, etc., would increase this one-quarter of a cent per bushel, or to 443/4 cents for 2,000 pounds, or a little less than one-sixth of a cent per ton mile. For longer distances this would be still less. For operators who own their own barges and tow-boats the total cost, including wear and tear, is about 28 cents for 2,000 pounds.

By rail the cost between Winchester, Ky., and Covington has been \$2.70 per 2,000 pounds; Charleston, W. Va., to Lexington, Ky., 190 miles, \$1.82 for 2,000 pounds.

The number of freight and passenger steamers has nearly doubled, being in 1886 ten, as against six in 1875. These handled in 1886 41,000 tons of miscellaneous freight and carried 59,000 passengers. In addition to these, four good steamers run from the upper Kanawha to points on the Ohio, carrying freight and passengers at low

The report shows that a very considerable increase in traffic will result from extending the system of slack-water navigation to the lower reaches of the river. The records of the gaugereadings as to depths suitable for navigation show that the season for shipment from the Kanawha can be lengthened over 100 days

before it will equal in length the season in the Ohio from the Kanawha down. In addition to this it will enable the dealers to save much of the time now required to "double up" their tows after bringing them through the present narrow channel, and to take advantage of any rise in the Ohio following one in the Kanawha (an opportunity now frequently lost). This will virtually bring the Kanawha mines 300 miles nearer to the markets on the Ohio and Mississippi rivers.

We have in previous numbers given a full description of the interesting works on the Kanawha, and it is with great pleasure that we record the marked success attending their use. We commend the subject to all those who persistently malign the honest efforts of our legislators to develop the waterways of the country.

THE ANNUAL OUTPUT OF RAILROAD ROLLING STOCK.

THE Railroad Gazette has taken pains to collect quite complete and valuable statistics in regard to this industry, which is of great importance, not only from its magnitude, but more especially as indicating the growth and condition of our railroads, as well as constituting a large factor in our commerce.

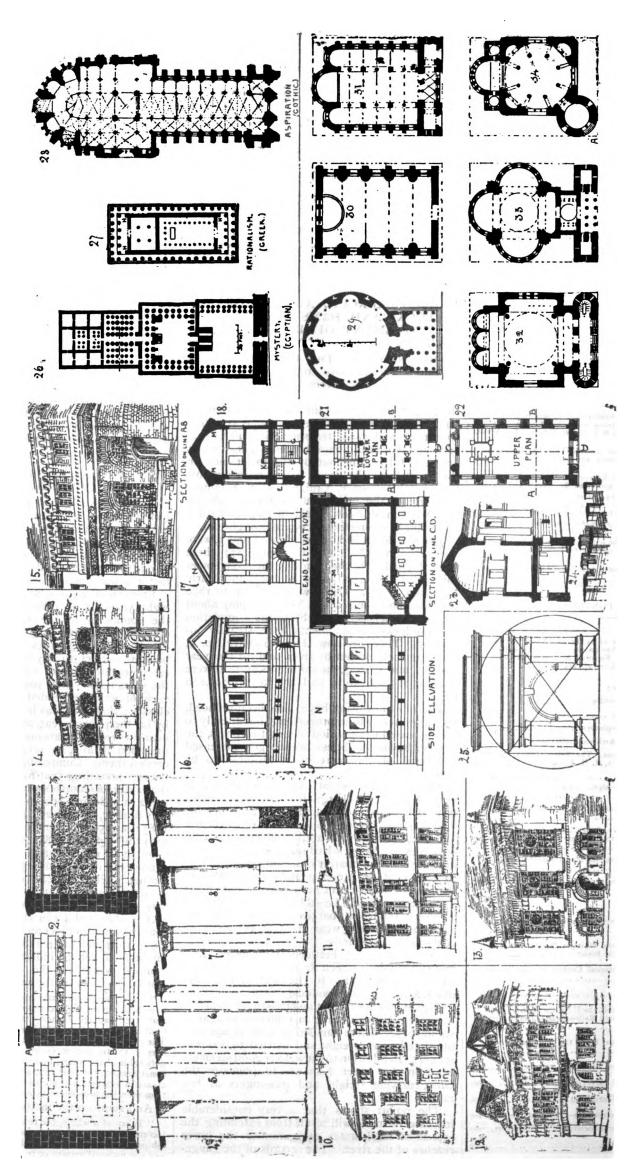
From these figures, which cover a period of eight years, from 1880 to 1887 inclusive, and the comments of the Gazette upon them, it appears that the largest output in most classes of rolling stock, or perhaps it would be more correct to say that probably the greatest aggregate value of output was in 1882, and the years immediately preceding and following, each of which exceeded it in some particular classes; that 1885 was in all but one small item by far the poorest year, and that 1887 had very nearly risen to the average of the best that had preceded it, and, in some respects, much exceeded them. Comparing it with the best and poorest preceding year for each class it appears that 2,044 locomotives were built in 1887, against 2,282 in 1882 and 800 in 1885; 16,145 freightcars in 1887, against 20,046 in 1881 and 3,555 in 1885; 14,056 coal-cars in 1887, against 8,100 in 1881 and 2,598 in 1885; 663 day passenger, baggage, mail, express, and caboose cars in 1887, against 587 in 1883 and 259 in 1885; 67 sleeping, dining, hotel, buffet cars, etc., in 1887, against 75 in 1881 and 17 in 1880; number of freightcars built per locomotive, 7.9 in 1887, against 10.1 in 1881 and 4.4 in 1885; and the number of coal-cars built per locomotive, 6.9 in 1887 against 4.9 in 1884 and 2.6 in 1880. These latter figures might be taken to indicate an increase in the hauling power of the locomotives, and this would appear to be the case, as the Gazette says:

"There can be but little doubt that the 2,044 locomotives built during 1887 represent a greater weigh and more haulage capacity than the 2,277 locomotives built in 1882, many of which were for the narrow gauge. The gradual increase in the number of engines with cylinders of 18, to and so inches in discrete the second se ders of 18, 19, and 20 inches in diameter has been very noticeable of late years, and when this fact is taken into consideration, the year 1887 shows a slightly smaller increase in numbers, but probably a larger increase in power than even the prosperous years 1882 and 1883."

And sums up the matter as follows:

"Taken as a whole, the returns certainly show that the locomotive and car-building industries are in a fairly flourishing condition, and the continued extension of railroads and the national growth of traffic on lines open will probably continue to provide plenty of work for locomotive makers and car-builders during the present year and for some time to come.'

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ELEMENTS OF ARCHITECTURAL DESIGN.

A SPEEDING-TRACK IN NEW YORK CENTRAL PARK.

THE petition signed by some millionaire owners of trotting-horses and a few of their friends, that a portion of the Central Park be devoted to a speeding-track for their convenience and that of their jockeys and trainers, has called out such an emphatic protest that we think some of them, at least, will regret their hasty action. It would be an outrage, indeed, to have the portion of the park it is proposed to devote to such purposes made unsafe and unfit for ladies and children, and such it would quickly become, since the speeding of trotters would attract all the stable boys, jockeys, and loafers in the city to the locality, and line the avenue facing the park with rum-shops, otherwise known as "road houses.

PHOTOGRAPHY OF MOVING PROJECTILES.

Some instantaneous photographs of bullets in motion have recently been taken in Germany by Herren Mach and P. Salcher, and are mentioned in Engineering. The object of the experiment was to determine the waves formed in the air displaced by the motion of the bullet. When the projectile had a velocity of only 780 feet per second no waves were observed, but with velocities of from 1,110 to 1,730 feet per second very distinct photographs were obtained showing, in the clearest possible manner, the character of the waves set up by the bullet in its passage. From these it would appear that the air flows away from the bullet in hyperbolic lines, whilst a vacuum is produced immediately behind it,

NEW YORK QUARANTINE STATION.

VIEWS ON HOFFMAN ISLAND, N. Y. HARBOR.

WE give on page 108 four views taken from photos loaned us by Mr. F. N. Owen, who had them taken at the time of visits of the committee whose report was published in our These sketches forcibly illustrate how an last issue establishment of this kind is maintained by the Empire State under the circumstances cited in our editorial of last week.

THE ANNUAL MEETING OF THE ARCHI-TECTURAL LEAGUE.

THE Architectural League held its annual meeting at Sieghortner's, 32 Lafayette Place, on the evening of Monday, the 9th inst., some seventy members being present, with Mr. John Du Fais, President, in the chair. Polls for election of officers were opened I P. M.

The officers elected are as follows: John Beverly Robinson, President; Frederick Crowninshield, Vice-President; members of Executive Committee, Henry O. Avery, Charles I. Berg, James D. Hunter.

The annual report of the treasurer shows the League to be in a most satisfactory financial condition, so much so that the members feel quite sure that the League will be housed in its own quarters before the end of the present year. The membership has been largely increased and shows a steady and constant growth.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE annual meeting of the society will be held January 18 and 19, 1888, at the society house, 127 East Twentythird Street, New York.

Wednesday, January 18.—The meeting will open at 10 o'clock, and will continue through the day. Lunch will be served at the society house at 13:30 o'clock.

During the meeting the annual reports will be presented; officers for the ensuing year elected; the awards of the Norman Medal and of the Rowland Prize for the past year announced; the place for the next convention considered; proposed amendments to the constitution discussed; reports from various committees presented and discussed; technical subjects discussed; general business trans-

In the evening a paper on the Panama Canal in 1887 by Lieutenant C. C. Rogers, U. S. N., will be read by the author and discussed.

Thursday, January 19.—The arrangements for this day will be announced in detail at or soon before the meeting. They will include a visit to the bridge in progress of construction across the Harlem Valley (two steel arches of 510 feet span each, and seven granite arches in approaches.)

In the evening a reception for gentlemen will be held at the house of the society, and at 21:30 o'clock supper will be served.

William G. Hamilton, Charles W. Hunt, and John Bogart are the committee

The total membership of the society including all grades was 1,110 on January 1, 1888.

OUR ARCHITECTURAL ILLUSTRATIONS. THE UNION DEPOT, NEW LONDON, CONN.

THE UNION DEPOT, NEW LONDON, CONN.

THIS building was built by the New York, New Haven and Hartford Railroad Company, the New London and Northern Railroad Company, and the New York, Providence and Boston Railroad Company. A special red brick was used, made at Cambridge, Mass., similar to that used in Sever Hall in that city; interior finish, quartered oak. It was built from sketches left by the late H. H. Richardson, under direction of his successors, Messrs. Shepley, Rutan & Coolidge, of Brookline, Mass., the builders being the Flint Building and Construction Company, of Palmer, Mass. Mass.

THE BATH-TUB IN POLITICS.

THE New York Star says: "The last hero of the bathtub in politics that has been discovered is Senator Blackburn. A raw-boned female from Kentucky applied to him the other day for a position in the Interior Department. As she did not get it as soon as she wished, she called at his lodgings, and, forcing her way past his servant, went up to his room. The Senator was reclining comfortably in his bath-tub, which was protected from public view by a curtain. The Kentucky female calmly took a seat outside the curtain, and announced to the Senator, with freezing politeness, that she didn't propose to leave until he had furnished her the place she wanted. The Senator tried to pacify her; but it was of no use, and finally he had to give his promise. The determined Kentucky woman is now drawing a salary from the Government, and Mr. drawing a salary from the Government, and M Blackburn has taken a solemn oath never to enter his bath again when an office-seeker is within a mile."

NOTICE.

SUBSCRIBERS desiring copies of back numbers of Volume XVI. are requested to order them at once, remitting ten cents for each number ordered. The publisher does not undertake to supply back numbers more than thirty days after the close of each volume.

ELEMENTS OF ARCHITECTURAL DESIGN.* BY H. H. STATHAM.

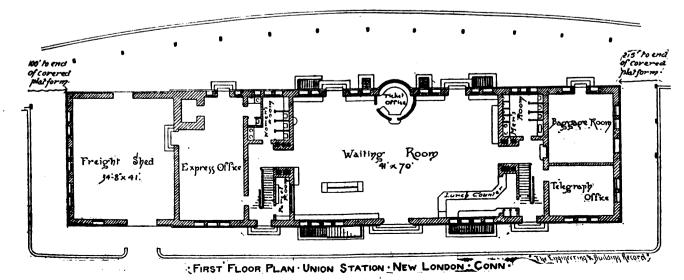
JUDGING from the nature of the correspondence architecture and the duty of architects which is frequently seen in columns of the daily papers, the Times especially, it would seem that the popular notion of archirecture now is that it is a study mainly of things connected with sanitary engineering—of the best forms of drainage and intercepting-traps. This is indeed a very important part of sound building, and it is one that has been very much neglected, and has been, in fact, in a comperatively primitive state until very recent times, and, therefore, it is not surprising that there should be a reaction in regard to it and that newspapers which follow every movement of public opinion, and try to keep pace with it, should speak as if the drain-pipe were the true foundation of architecture. I have a great respect for the drain-pipe, and wish to see it as well laid and "intercepted" as possible; but I think, for all that, there is something in architecture higher than sanitary engineering. I wish to consider it in these lectures as what I think it essentially is what it has evidently been in the eyes of all those of past days who have produced what we now regard as great architectural monuments—namely, as an intellectual art, the object of which is to so treat the buildings which we are obliged to raise for shelter and convenience as to render them objects of interest and beauty, and not mere utilitarian floors, walls, and roofs to shelter a race who care nothing for beauty, and who only want to have their physical comfort provided for.

Architecture, then, from the point of view from which I am asking you to regard it—and the only point of view in which it is worth the serious regard of thoughtful people —is the art of erecting expressive and beautiful buildings. I say expressive and beautiful, and I put expressive first, because it is the characteristic which we can at least realize even when we cannot realize what can fairly be called beauty, and it is the characteristic which comes first in the order of things. A building may be expressive and thereby have interest, without rising into beauty; but it

thereby have interest, without rising into beauty; but it can never be, architecturally speaking, beautiful unless it has expression. And what do we mean by expression in a building? That brings us to the pith of the matter.

We know pretty well what we mean when we say that a painted or sculptured figure is expressive. We mean that, while correctly representing the structure of the human figure, it also conveys to our minds a distinct idea of a special emotion or sentiment such as human beings are capacial emotion or sentiment, such as human beings are capa-ble of feeling and expressing by looks and actions. Ex-pression in this sense a building cannot be said to have. It is incapable of emotion, and it has no mobility of sur-face or feature. Yet I think we shall see that it is capable of expression in more senses than one. It may, in the first place, express or reflect the emotion of those signed it, or it may express the facts of its own internal structure and arrangement. The former, however, can only, I think, be said to be realized in the case of architecture of the higher class, and when taken collectively as a typical style. For instance, we can all pretty well agree a typical style. For instance, we can all pretty well agree that the mediæval cathedral expresses an emotion of aspiration on the part of its builders. The age that built the cathedrals longed to soar in some way, and this was the way then open to it, and it sent up its soul in spreading vaults, and in pinnacles and spires. So also we can never look at Greek architecture without seeing in it the reflection of a nature refined, precise, and critical; loving grace and finish, but content to live with the graces and the muses without any aspirations that spurned this earth. We can hardly go further than this in attributing emotional expression to architecture. But in a more restricted sense of the word expression, a building may express very definitely its main constructive facts, its may express very definitely its main constructive facts, its plan and arrangement, to a certain extent even its purpose, so far at least that we may be able to identify the class of structure to which it belongs. It not only may, but it ought to do this, unless the architecture is to be a mere ornamental screen for concealing the prosaic facts of

* Cantor lecture before Society of Arts, from the Journal of the Society of Arts.



the structure. There is a good deal of architecture in the world which is, in fact, of this kind—an ornamental screen unconnected with the constructional arrangement of the building; nor is such architecture to be entirely of the building; nor is such architecture to be entirely scouted; it may be a very charming piece of scenery in itself, and you may even make a very good theoretical defence for it, from a certain point of view; but, on the whole, architecture on that principle becomes uninteresting; you very soon tire of it; it is a mask rather than a countenance, and tends to the production of a dull uniformity of conventional design.

For we must remember that architecture, although a form of artistic expression, is not, like painting and sculpture, unfettered by practical considerations; it is an art inextricably bound up with structural conditions and practical requirements. A building is erected first for convenience and shelter; secondly only for appearance, except in the case of such works as monuments, triumphal arches, the which represent architectural effect pure and simple in the case of such works as monuments, triumphal arches, etc., which represent architectural effect pure and simple, uncontrolled by practical requirements. With such exceptions, therefore, a building ought to express in its external design its internal planning and arrangement; in other words, the architectural design should arise out of the plan and disposition of the interior, or be carried on concurrently with it, not designed as a separate problem. Then a design is dependent on structural conditions also, and if these are not observed the building does not stand, and hence it is obvious that the architectural design must and hence it is obvious that the architectural design must express these structural conditions; it must not appear to stand, or be constructed in a way in which it could not stand (like the modern shops which are supposed to stand on sheets of plate-glass), and its whole exterior appearance ought to be in accordance with, and convey the idea of, ought to be in accordance with, and convey the idea of, the manner and principle on which it is constructed. The most important portions of the interior must be shown as such externally by the greater elaboration and emphasis of their architectural treatment. If the general arrangement of the plan is symmetrical, on either side of a centre (which, however, it cannot often be, except in the largest type of monumental or public buildings), the architectural treatment must be symmetrical; if the building is necessarily arranged, in accordance with the requirements of the plan unsymmetrically, the architectural treatment must the plan unsymmetrically, the architectural treatment must follow suit, and the same principle must be carried out through all the details.

Now this dependence of architectural design unon plan

low this dependence of architectural design upon plan and construction is one of the conditions which is often overlooked by amateurs in forming a judgment upon architectural design; and the overlooking of this is one reason of the uncertainty of opinion about architecture as compared with such arts as sculpture and painting. Few people know or care much about the structure and planpeople know or care much about the structure and planning of buildings except those whose business it is to care about this; and consequently they do not realize what it is which they should look for in the architectural design. They like it or do not like it, and they regard this as what is called a mere question of taste, which, according to the proverb, is not to be disputed about. In fact, however, the good or bad taste of an architectural design, say, if you like, its correctness or incorrectness, is to a considerable extent a matter of logical reasoning, of which you must accurately know the premises before you can form a must accurately know the premises before you can form a just conclusion. But there is another reason for this prevjust conclusion. But there is another reason for this prevalent uncertainty and vagueness of opinion, arising out of the very nature of architectural art itself, as compared with the imitative arts. A painting of a figure on a landscape is primarily a direct imitation of the physical facts of nature. I do not for a moment say it is only that, for there is far more involved in painting than the imitation of nature; but the immediate reference to nature does give a standard of comparison which to a certain event give a standard of comparison which to a certain extent every eye can appreciate. But architecture is not an art which imitates natural forms at all, except as minor deco-rations, and it then does so, or should do so, only in a conventionalized manner, for reasons which we shall consider later on. Architecture is, like music, a metaphysical art; it deals with the abstract qualities of proportion, balance of form, and direction of line, but without any imitation of the concrete facts of nature. The comparison between architecture and music is an exercise of the fancy tion of the concrete facts of nature. The comparison between architecture and music is an exercise of the fancy which may indeed be pushed too far, but there is really a definite similarity between them which it is useful to notice. For instance, the regular rhythm, or succession of accentuated points in equal times, which plays so important a part in musical form, is discernible in architecture as a rhythm in space. We may treat a cottage type of design, no doubt, with a playful irregularity, especially if this follows and is suggested by an irregularity of plan; but in architecture on a grand scale, whether it be in a Greek colonnade or a Gothic arcade, we cannot tolerate irregularity of spacing, except where some constructive necessity affords an obvious and higher reason for it. Then, again, we find the unwritten law running throughout all architecture that a progress of line in one direction requires to be stopped in a marked and distinct manner when it has run its course, and we find a similarly felt necessity in regard to musical form. The repetition so common at the close of a piece of music of the same chord several times in succession, is exactly analogous to the common at the close of a piece of music of the same chord several times in succession, is exactly analogous to the repetition of cross lines at the necking of a Doric column to stop the vertical lines of the fluting, or to the strongly-marked horizontal lines of a cornice which form the termination of the height or upward progress of an architectural design. The analogy is here very close. A less close analogy may also be felt between an architectural and a musical composition regarded as a whole. A fugure of musical composition regarded as a whole. A fugue of Bach's is really a built-up structure of tones (as Browning has so finely put it in his poem, "Abt Vogler"), in

accordance with certain ideas of relation and proportion accordance with certain ideas of relation and proportion, just as a temple or a cathedral is a built-up structure of lines and spaces in accordance with ideas of relation and proportion; both appeal to the same sense of proportion and construction in the brain, the one through the ear, the other through the eye. Then, in regard to architecture again, we have further limiting conditions arising not only again, we have further limiting conditions arising not only out of the principle of construction employed, but out of the physical properties of the very material we employ. A treatment that is suitable and expressive for a stone construction is quite unsuitable for a timber construction; details which are effective and permanent in marble are ineffective and perishable in stone, and so on; and the outcome of all this is that all architectural design has to outcome of all this is that all architectural design has to be judged not by any easy and ready reference to exterior physical nature, with which it has nothing to do, but by a process of logical reasoning as to the relation of the design to the practical conditions, first, which are its basis, and as to the relation of the parts to each other. Of course, beyond all this, there is in architecture, as in music, something which defies analysis, which appeals to our sense of delight we know not how or why, and probably we do not want to know; the charm might be dissolved if we did. But up to this point architectural design and expression are based on reasoning from certain premises; the design are based on reasoning from certain premises; the design is good or bad as it recognizes or ignores the logic of the case, and the criticism of it must rest on a similar basis. It is a matter of thought in both cases, and without thought it can neither be designed nor appreciated to any purpose, and this is the leading idea which I wish to urge and to illustrate in these lectures.

You may say, may not a design satisfy all these logical conditions, and yet be cold and uninteresting, and give one no pleasure? Certainly it may; indeed, we referred just now to that last element of beauty which is beyond analysis; but if we cannot analyze the result, I rather think we can express what it is which the designer must express beyond clear reasoning to give the highest interest think we can express what it is which the designer must evince, beyond clear reasoning, to give the highest interest to his architecture. He must have taken pleasure and interest in it himself. That seems a little thing to say, but much lies in it. As Matthew Arnold has said of poetry:

"What poets feel not, when they make A pleasure in creating, The world, in its turn, will not take Pleasure in contemplating."

The truth runs through all art. There are, alas! so many people who do not seem to have the faculty of tak-ing pleasure; and there is so much architecture about our many people who do not seem to have the faculty of taking pleasure; and there is so much architecture about our streets which it is impossible to suppose any one "took pleasure in creating." When a feature is put into a design not because the designer liked it, but because it is the usual thing and it saves trouble, it always proclaims that melancholy truth. But where something is designed because the designer liked doing it, and was trying to please his own fancy instead of copying what a hundred other men have done before, it will go hard, but he will give some pleasure to the spectator. It is from this blessed faculty that a design becomes inspired with what is best described as "character." It is not the same thing as style. I have something to say in my next lecture as to what I think style means; but it is certain that a building may have style and yet want character, and it may have a good deal of character and yet be faulty or contradictory in style. We cannot define "character," but when we feel that it is present we may rely upon it that it is because the designer took interest and pleasure in his work; was not doing it merely scholastically—in short, he put something of his own character into it; which means that he had some to put.

Now, coming back to the axiom before mentioned, that architectural design should everees and emphasize the

had some to put.

Now, coming back to the axiom before mentioned, that architectural design should express and emphasize the practical requirements and physical conditions of the building, let us look a little more in detail into the manner in which this may be done. We will take, to begin with, the very simplest structure we can possibly build—a plain wall. Here there is no expression at all; only stones piled one on another, with sufficient care in coursing and jointing to give stability to the structure. It is better for the wall—constructively, however—that it should have a wider base, to give it more solidity of foundation, and that jointing to give stability to the structure. It is better for the wall—constructively, however—that it should have a wider base, to give it more solidity of foundation, and that the coping should project beyond the face of the wall, in order to throw the rain off, and these two requirements may be treated so as to give architectural expression to our work. It now consists of three distinct portions—a plinth, or base, a superficies of wall, and a coping. 4We will mark the thickening at the base by a molding, which will give a few horizontal lines, and the coping in the same way. The molding of the coping must also be so designed as to have a hollow throating, which will act as a drip, to keep the rain from running down the under side of the coping and down the wall. We may then break up the superficies by inserting a band of single ornament in one course of this portion of the wall; not half-way, for to divide any portion of the building into mere "halves" has usually a weak and monotonous effect, but about two-thirds of the distance from the base line, and this band of ornament not only breaks up the plain surface a little, but also, by carrying another horizontal line along the wall, emphasizes its horizontality. Always emphasize that which is the essential characteristic of your structure. A wall of this kind is essentially a long horizontal boundary; emphasize its length and horizontality. If we are millionaires, and can afford to spend a great deal on a wall, we may not only carry further the treatment of the coping and base, by giving them ornamental adjuncts as well as moldings, but we might treat the whole wall-superficies as a ornament not only breaks up the plain surface a little, but also, by carrying another horizontal line along the wall, emphasizes its horizontality. Always emphasize that which is the essential characteristic of your structure. A wall of this kind is essentially a long horizontal boundary; emphasize its length and horizontality. If we are millionaires, and can afford to spend a great deal on a wall, we may not only carry further the treatment of the coping and base, by giving them ornamental adjuncts as well as moldings, but we might treat the whole wall-superficies as space for surface carving, not mechanically repeated, but

with continual variation of every portion, so as to render with continual variation of every portion, so as to render our wall a matter of interest and beauty while retaining all its usefulness as a boundary, observing that such surface ornament should be designed so as to fulfill a double object, (1st) to give general relief to the surface of the wall; (2d) to afford matter of interest to the eye on close inspection and in detail. That is the double function of nearly all architectural ornament; it is, in the first place, to aid the general expression and balance of the building, and give point and emphasis where needed; and in the second give point and emphasis where needed; and, in the second place, to furnish something to the eye for study on its own account when viewed more closely.

We will take another typical and simple erection, a stone pillar to support the ends of two lintels or beams. This may be simply a long squared piece set on end, and will perform its constructive functions perfectly well in that form; but it is not only absolutely expressionless, but is in one sense clumsy and inconvenient, as taking up more space than need be, presenting an unwieldy-looking mass when viewed at an angle, and shutting out a good deal of light (if that happens to be a matter of consequence in the case). Cutting off the angles does not weaken it much, and renders it much less unwieldy-looking, besides giving it a certain degree of verticality of expression, and render-ing it more convenient as taking up less room and obstruct-ing less light. But though the column is quite strong ing less light. But though the column is quite strong enough, the octagonal top does not make so good a seat or bearing for the ends of the lintels; we will therefore put a flat square stone on the top of it which will serve as a bed for the lintels to rest on securely. But the angles of this bed-plate, where they project beyond the face of the column, appear rather weak, and are so actually to some extent—a double defect, for it is not enough in architecture that their appeals to the strong account it is necessarily to the strong account to the strong account the strong accou ure that a thing should be strong enough, it is necessary that it should appear so, architecture having to do with ex-pression as well as with fact. We will, therefore, strengthen this projecting angle, and correct the abrupt-ness of transition between the column and the bed-plate ness of transition between the column and the bed-plate by brackets projecting from the alternate faces of the column to the angles of the bed-plates. As this rather emphasizes four planes of the octagon column at the expense of the other four, we will bind the whole together just under the brackets by a thin band of ornament constituting a necking, and thus we have something like a capital developed, a definitely designed finish to our column, expressive of its purpose. This treatment of the upper end would make the lower end rising abruptly from the ground seem very bare. We will accordingly emphasize the base of the column, just as we emphasized the base of the wall, by a projecting molding, not only giving size the base of the column, just as we emphasized the base of the wall, by a projecting molding, not only giving expression to this connection of the column with the ground, but also giving it the appearance, and to some extent the reality, of greater stability, by giving it a wider and more spreading base to rest on. We have here still left the lines of one column vertically parallel, and there is no constructive reason why they should not remain so; there is, however, a general impression to the eye both of greater stability and more grace arising from a slight diminution upward. It is difficult to account for this on any metaphysical principle, but the fact has been felt by most nations which have used a columnar architecture, and we will accept it and diminute (so to speak) our colmost nations which have used a columnar architecture, and we will accept it and diminute (so to speak) our column. We have here taken a further step by treating the shaft of the column in two heights, keeping the lower portion octagonal and reducing the upper portion to a circle, and we now find it easier to treat the capital so as to have a direct and complete connection with the column, the capital being here merely a spreading out of the column into a bracket form all round, running it into the square of the bed-plate.* The spreading portion is emphasized by surface ornament, and the necking is again emphasized, this time more decisively, by a molding, forming a series of parallel rings round the column. If we wish to give our column an expression of more grace and elegance, we can further reduce the thickness of it and give more spread to the capital, always taking care to be sure that spread to the capital, always taking care to be sure that the strengh of the column is not reduced below what the weight which it has to carry requires. In this case a bracket is shown above the capital, projecting longitudinally only (in the direction of the lintel bearing), a method nally only (in the direction of the lintel bearing), a method of giving a larger bearing-surface for the ends of the lintels, shortening their actual bearing† (in other words, widening the space which can be bridged between column and column), and giving a workmanlike appearance of stability to the construction at this point. The idea of the division of the column into two sections, suggested in Fig. 8, is kept up in Fig. by treating the lower portion up to the same height into two sections, suggested in Fig. 8, is kept up in Fig. 9, by treating the lower portion, up to the same height with incised decorative carving. The dotted lines on each side in Fig. 9 give the outline of the original square column as shown in Fig. 4. The finished column was within that block; it is the business of the architectural designer to get it out. \(\frac{1}{2}\)

Let us see if we can apply the same kind of process of evolving expression in regard to a building. We will take again the very simplest form of building (Fig. 10), a square house with a door in the centre and uniform rows



There cannot be said to be any architectural expression in this; there is no base or plinth at all, no treatment of the wall; the slight projection at the eaves is only what is necessary to keep the rain from running down the walls, and facilitate the emptying of the gutters, down the walls, and facilitate the emptying of the gutters, and the even spacing of the windows is essential for constructive reasons, to keep the masses of wall over each other, and keep the whole in a state of equally balanced pressure. The first thing we should do in endeavoring to give some expression to the building would be to give it a base or plinth (Fig. 11), and to mark that and the cornice a little more decidedly by moldings and a line of paneling at the plinth. The house being obviously in three stories, we should give it some echo externally of this division into horizontal stages by horizontal moldings, what are called we should give it some echo externally of this division into horizontal stages by horizontal moldings, what are called in architectural phraseology, "string courses," not necessarily exactly at the floor-levels, but so as to convey the idea of horizontal division; observing here, as in the case of the wall and column, that we should take care not to divide the height into equal parts, which is very expressionless. In this case we will keep the lower string close down on the ground-floor windows, and keep these rather low, thus showing that the ground-floor apartments are not the most important; while the fact that the first floor ones are so is conversely made apparent by keeping these not the most important; while the fact that the first floor ones are so is conversely made apparent by keeping these windows rather higher, putting a double string-course over them, and a slight extra depth of molding, forming a kind of cornice over each. The space left between these and the roof, in which the attic windows are placed, is treated with a series of mullions and panelings, into which the attic windows are worked, as part of the series of openings; this gives a little richness of effect to the top story, and a continuity of treatment, which binds the whole series of windows together. To have treated the whole of the walls and windows in this way would have been merely ings; this gives a little richness of effect to the top story, and a continuity of treatment, which binds the whole series of windows together. To have treated the whole of the walls and windows in this way would have been merely throwing away labor; what little effect it has consists in the "character" given by the contrast of this top story treatment with the plain wall surfaces below. The last thing is to emphasize the door, as the principal opening in the walls, and quite distinct in use and meaning from the other openings, by giving it a little architectural frame or setting, which may be done in many ways, but in this case is done by the old-fashioned device (not very logical certainly) of putting a little entablature over it, and a column on either side. There is, however, this to be said for it, that the projecting tablature forms a semi-porch, protecting those at the door somewhat from rain; it must be carried in some way, and columns are the readiest and most seemly manner of doing it, and they also form, practically, something of a weather screen; the bases on which they stand also form a frame-work or enclosing wall for the steps, which are thus made part of the architectural design, instead of standing out as an eyesore, as on Fig. 10. We have now given the house a little general expression, but it still is vague in its design as far as regards the distribution of the interior; we do not know whether the sion, but it still is vague in its design as far as regards the distribution of the interior; we do not know whether the first floor, for instance, is one large room, or two or more first floor, for instance, is one large room, or two or more rooms, or how they are divided; and the little house is very square and prim in effect. Let us try grouping the windows a little, and at the same time breaking up the flat surface of the front wall (Fig. 12). Here as before, we have divided the building by a horizontal string, but only by one main one on the first floor level, keeping the same contrast, however, between a richer portion above and a plainer portion below; we have divided the building vertically, also, by two projecting bays finishing in gables, thus breaking also the skyline of the roof, and giving it a little picturesqueness, and we have grouped the windows. little picturesqueness, and we have grouped the windows, instead of leaving them as so many holes in the wall at equal distances. The contrast between the ground and first floor windows is more emphatic; and it is now the more evident that the upper floor rooms are the best apart-ments, from their ample windows; it is also pretty evident that the first floor is divided into two main rooms with large bay windows, and a smaller room or a staircase window between them; the second floor windows are also dow between them; the second floor windows are also shifted up higher, the two principal ones going in to the gables, showing that the rooms below them have been raised in height. Windows carried up the full height of these rooms, however, might be too large either for repose internally, or for appearance externally, so the wall intervening between the top of these and the sill of the gables is a good field for some decorative treatment, confined to the bays, so as to assist in separating them from the straight wall which forms the background to them.

So far we have treated our building only as a private house. Without altering its general scale and shape, we may suggest something entirely different from a private house. On Fig. 13, we have tried to give a municipal appearance to it, as if it were the guildhall of a small country town. The plain basement and the wide principal doorway, and the row of three very large equal spaced windows above, render it unquestionable that this is a building with a low ground story, and one large room above; a certain the strain of the strain

So far we have treated our building only as a private house. Without altering its general scale and shape, we may suggest something entirely different from a private house. On Fig. 13, we have tried to give a municipal appearance to it, as if it were the guildhall of a small country town. The plain basement and the wide principal doorway, and the row of three very large equal spaced windows above, render it unquestionable that this is a building with a low ground story, and one large room above; a certain "public building" effect is given to it by the large and enriched cornice with balustrade above and paneling below, and by the accentuation of the angles by projecting piers, and by the turrets over them, which give it quite a different character from that of a private house. If, on the other hand, the building were the free library and reading-room of the same small country town, we should have little doubt of this, if we saw it as in Fig. 14, with the walls all blank (showing that they are wanted for ranging something against, and cannot be pierced for windows), and windows only in the upper portion. Similarly, if we want to build it as the country bank, we should have to put the large windows on the ground floor, bank clerks wanting plenty of light, and the ground story being always the

principal one; and we might indulge the humor of giving it a grim fortress-like strength by a rusticated plinth $(i.\ e.,\ \text{stones}\ \text{left}$ or worked rough and rock-like), and by very massive piers between the windows, and a heavy cornice over them; the residential upper floor forming a low story subordinate to the bank story. It is true this would not satisfy a banker, who always wants classic pilasters stuck against the walls, that being his hereditary idea of bank expression in architecture.

bank expression in architecture.

Now, if we proceed to take to pieces the idea of architectural design, and consider wherein the problem of it consists, we shall find that it falls into a fourfold shape. It consists first in arranging the plan; secondly, in carrying up the boundary lines of this plan vertically in the shape of walls; thirdly, in the method of covering in the space which we have thus defined and enclosed; and, fourthly, in the details of ornamentation which give to it the last and concluding grace and finish. All building, when it gets beyond the mere wall with which we began, is really a method of covering in a space, or, if we may put it so, a collection of spaces, marked out and arranged for certain purposes. The first thing that the architect has to do is to arrange these spaces on the ground so that they may conveniently meet the necessary requirements of the building. Convenience and practical usefulness come first; but in any building which is worth the name of architecture something more than mere convenience has to be kept in mind, even in the arrangement of the plan upon the site. It is to be a combination of convenience with effectiveness of arrangement. We shall probably find that some one compartment of the plan is of paramount importance. We have to arrange the interior so that this most important compartment shall be the climax of the plan.

The entrance and the other subsidiary compartments must be kept subordinate to it, and must lead up to it in such a manner that the spectator shall be led by a natural gradation from the subsidiary compartments up to the main one, which is the centre and raison d' etre of the wholeonc, which is the centre and ration a letter of the whole—
everything in the lines of the plan should point to that.
This is the great crux in the planning of complicated public buildings. A visitor to such a building, unacquainted with it previously, ought to have no difficulty in finding out from the disposition of the interior which are the main out from the disposition of the interior which are the main lines of route, and when he is on the line leading him up to the central feature of the plan. There are public buildings to be found arranged on what may be called the rabbit-warren system, in which perhaps a great number of apartments are got upon the ground, but which the visitor is obliged laboriously to learn before he can find his way hout them. They is not only incorporates, but insartistic about them. That is not only inconvenient, but inartistic planning, and shows a want of logic and consideration, and, in addition to this, a want of feeling for artistic effect. and, in addition to this, a want of feeling for artistic effect.

I saw not long ago, for instance, in a set of competitive designs for an important public building, a design exhibiting a great deal of grace and elegance in the exterior architectural embellishment, but in which the principal entrance led right up to a blank wall facing the entrance, and the spectator had to turn aside to the left and then to the right before finding himself on the principal axis of the plan. That is what I should call inartistic or unarchitectural That is what I should call inartistic or unarchitectural planning. The building may be just as convenient when you once know its dodges, but it does not appear so, and it loses the great effect of direct vista and climax. An able architect, who had given much thought to a plan of a large building of this kind, said to me, in showing me his plan, with a justifiable gratification in it: "It has cost me and less trouble, but, it is a satisfaction to feel that you endless trouble, but it is a satisfaction to feel that you have got a plan with backbone in it." That is a very good expression of what is required in planning a compligood expression of what is required in planning a complicated building, but few outsiders have any notion of the amount of thought and contrivance which goes to the production of a plan "with backbone;" a plan in which all the subordinate and merely practical departments shall be in the most convenient position in regard to each other, and yet shall all appear as if symmetrically and naturally subordinate to the central and leading feature; and if the public had a little more idea what is the difficulty of producing such a plan they would perhaps do a little more public had a little more idea what is the difficulty of producing such a plan, they would perhaps do a little more justice to the labors of the man who contrives the plan, which they think such an easy business; and no doubt it may appear an easy business, because the very characteristic of a really good plan is that it should appear as if it were quite a natural and almost inevitable arrangement. Just as it is said in regard to literature, that easy writing is hard reading, so, in regard to planning, it is the complicated and rabbit-warren plans that are the easiest to make, because it is just doing what you please; it is the apparently perfectly simple and natural plan which springs apparently perfectly simple and natural plan which springs from thought and contrivance. Then there is the next step of raising the walls on the plan, and giving them architectural expression. This must not be thought of as an entirely separate problem, for no truly architectural intellect will ever arrange a plan without seeing generally, in his mind's eye, the superstructure which he intends to rear upon it; but the detailed treatment of this forms a separate branch of the design. Then comes the third and very important problem, the covering in of the space. Next to the plan this is the most important. All building is the covering over of a space, and the method of covering it over must be foreseen and provided for from the outset; it largely inof a space, and the method of covering it over must be foreseen and provided for from the outset; it largely influences the arrangement of the plan. If there were no roofing you could arrange the walls and carry them up pretty much as you chose, but the roofing of a large space is another matter; it requires extra strength at certain points, where the weight of the roof is concentrated, and it has to be determined whether you will employ a method of roofing which exercises only a vertical pressure on the

walls, llke the lid of box, or one which, like an arch, or a vault, or a dome, is abutting against the walls, and requires counterforts to resist the outward thrust of the roof. We shall come upon this subject of the influence of the roof on the design of the substructure more in detail later on. Then, if the plan is convenient and effective, the walls carried up with the architectural expression arising from the placing and grouping of the openings, and the proper emphasizing of the base and cornice, and the horizontal stages (if any) of the structure, and the roof firmly and scientifically seated on the walls; after all these main portions of the structure are designed logically and in accordance with one another, and with the leading idea of the building, then the finishing touches of expression and interest are given by well designed and effective ornamental detail. Here the designer may indulge his fancy as he pleases, as far as the naure of the design is concerned, but not, if you please, as far as its positions and distribution are concerned. There the logic of architecture still pursues us. We may not place ornament anywhere at haphazard on a building simply because it looks pretty; at least, to do so is to throw away great part of its value. For everything in architectural design is relative; it is to be considered in relation to the expression and design of the whole, and ornament is to be placed where it will emphasize certain points or certain features of the building. It must form a part of the grouping of the whole, and be all referable to a central and predominating idea. A building so planned, built, and decorated, becomes in fact what all architecture—what every artistic design in fact should be—an organized whole, of which every part has its relation to the rest, and from which no feature can be removed without impairing the unity and consistency of the design. You may have a very good, even an expressive building, with no ornament at all if you like, but you may not have misplaced ornament; t

I have thought that it would be of use to those who are unacquainted with architectural procedure in delineating architecture by geometrical drawings, if I took the opportunity of illustrating very briefly the philosophy of elevations, plans, and sections, which many non-professional people certainly do not understand. A simple model of a building, like that in Fig. 16, will serve the purpose, as the principle is the same in the most complicated as in the simplest building. It must be remembered that the object of architectural drawings on the geometrical system is not to show a picture of the building, but to enable the designer to put together his design accurately in all its parts, according to scale, and to convey intelligible and precise information to those who have to erect the building. A perspective drawing like Fig. 16 is of no use for this purpose. It shows generally what the design is, but it is impossible to ascertain the size of any part by scale from it, except that if the length of one line were given it would be possible, by a long process of projection and calculation, to ascertain the other sizes. The rationale of the architect's geometrical drawings is that on them each plane of the building (the front, the side, the plan, etc.), is shown separately and without any distortion by perspective, and in such a manner that every portion is supposed to be opposite to the eve at once. Only the width of any I have thought that it would be of use to those who are tive, and in such a manner that every portion is supposed to be opposite to the eye at once. Only the width of any object on one side can be shown in this way at one view; for the width of the return side you have to look on another drawing; you must compare the drawings in order to find out those relative proportions which the perspective view out those relative proportions which the perspective view indicates to the eye at a glance; but each portion of each side can be measured by reference to a scale, and its precise size obtained, which can only be guessed at roughly from the perspective drawing. Thus the side of the model is shown in Fig. 19, the end in Fig. 17; the two together give the precise size and proportions of everything outside to scale, except the projection of the pilasters; this has to be got at from the plan and section. Everything being drawn on one plane, of course surfaces which are sloping on one elevation are represented as flat in the other: for on one elevation are represented as flat in the other; for instance, on No. 17, the raking line of the sloping roof is shown at N, so we know the slope of the stoping roof is shown at N, so we know the slope of the roof, but we do not know to what length it extends the other way. This is shown on Fig. 19, where the portion showing the roof is also marked N, and it will be seen that the surface, which is sloping in Fig. 17, is seen in the side elevation only as is sloping in Fig. 17, is seen in the side elevation only as a space between a top and bottom line; we see the length of the roof here, and its height, but for its slope we go to the end elevation. Neither elevation tells us, however. what is inside of the building; but the section, Fig. 18, shows us that it has an arched ceiling, and two stories, a lower and a higher one. The section is the building cut in half, showing the end of the walls, the height and depth of the window openings, the thickness of the floor, etc., and as all parts which are opposite the eye are shown in the drawing, the inside of the cross-wall at the end of the building is shown as a part of the section drawing, he and as an parts which are opposite the cyc are shown in the drawing, the inside of the cross-wall at the end of the building is shown as a part of the section drawing, between the sectional walls. In Fig. 23 the section is sketched in perspective, to show more clearly what it means. Another section is made lengthways of the building, Fig. 20. It is customary to indicate on the plan the dotted lines the portion through which the section is supposed to be made: thus on the plans the lines A B and C D are drawn, and the corresponding sections are labeled with the same lines. As with the elevation, one section must be compared with another to get the full information from them. Thus in Fig. 18, the ceiling M, is shown as a semicircle; in Fig. 20 it is only a space between the top and bottom line; it is, certainly, shaded here to give the effect of rotundity, but that is quite a superfluity. On Fig. 18 the height of the side windows

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is shown at F, and the thickness of the wall in which they is shown at F, and the thickness of the wall in which they are made; in Fig. 20, F, their width and spacing are shown. In Fig. 18 some lines drawn across, one over the other, are shown at H; these are the stairs, of which in this section we see only the fronts, or risers, so that they apsection we see only the fronts, or risers, so that they appear merely as lines (showing the edge of each step) drawn one over the other. At H on the plan, Fig. 21, we again see them represented as a series of lines, but here we are looking down on the top of them, and see only the upper surfaces or "treads," the edges again appearing as a series of lines. At H on the longitudinal section, we see the same steps in section, and consequently their actual slope, which, however, could have been calculated from Figs. 18 and 21, by putting the heights shown in section with the width shown in plan. The plan, Fig. 21, shows the thickness and position on the floor of the pillars G G; their height is shown in the sections. The plan of a building is merely a horizontal section, cutting off the top, and looking down on the sectional top of the walls, so as to see all their thicknesses. I have drawn (Fig. 24) a to see all their thicknesses. I have drawn (Fig. 24) a perspective sketch of one end of the plan (Fig. 22) of the building, on the same principle as was done with the section (Fig. 23), in order to show more intelligibly exactly what it is that a plan represents—the building with the pages lifted of

upper lifted off.

Returning for a moment to the subject of the relation between the plan and the exterior design, it should be noted that the plan of a building being practically the first consideration, and the basis of the whole design, the latter consideration, and the basis of the whole design, the latter should be in accordance with the principle of disposition of the plan. For example, if we have an elevation (shown in diagram) showing two wings of similar design on either side of a centre, designed so as to convey the idea of a grand gallery, with a suite of apartments on either side of similar importance, if the one side only of the plan con-tains such a suite, and the opposite side is in reality divided up into small and inferior rooms, filled in as well as may be behind the architectural design, the whole design is in that case only a blind or screen, giving a false exterior symmetry to a building which is not so planned. This is an extreme case, or might be called so if it were not actually of pretty frequent occurrence; but it illustrates in a broad sense a principle which must be carried out in all cases, if the architecture is to be a real expression of the facts of the building

cases, if the architecture is to be a real expression of the facts of the building.

In this lecture, which is concerned with general principles, a word may fittingly be said as to the subject of proportion, concerning which there are many misapprehensions. The word may be, and is, used in two senses: first in regard to the general idea suggested in the words "a well-proportioned building." This expression, often vaguely used, seems to signify a building in which the balance of parts is such as to produce an agreeable imvaguely used, seems to signify a building in which the balance of parts is such as to produce an agreeable impression of completeness and repose. There is a curious kind of popular fallacy in regard to this subject, illustrated in the remark which used to be often made about St. Peter's, that it is so well-proportioned that you are not aware of its great size, etc.; a criticism which has been slain over and over again, but continues to come to life again. The fact that this building does not show its size is true; but the inference drawn is the very reverse of the truth—one object in architectural is the very reverse of the truth—one object in architectural design is to give full value to the size of a building—even to magnify its apparent size; and St. Peter's does not show its size, because it is ill-proportioned, being merely like a smaller building with all its parts magnified; hence the deception to the eye, which sees details which it is accustomed to see on a smaller scale, and underrates their certual size, which is only to be ascertained by deliberate actual size, which is only to be ascertained by deliberate investigation. This confusion as to scale is a weakness inherent in the classical forms of columnar architecture, inherent in the classical torms of columnar architecture, in which the scale of all the parts is always in the same proportion to each other and to the total size of the building, so that a large Doric temple is in most respects only a small one magnified. In Gothic architecture the scale is the human figure, and a larger building is treated, not by magnifying its parts, but by multiplying them. Had this procedure been adopted in the case of St. Peter's, instead of merely treating it with a columnar order of vast size, with all its details magnified in proportion, we should not have the fault to find with it that it does not produce not have the fault to find with it that it does not produce the effect of its real size. In another sense, the word "proportion" in architecture refers to the system of designing buildings on some definite geometrical system of regulating the sizes of the different parts. The Greeks of regulating the sizes of the different parts. The Greeks certainly employed such a system, though there are not sufficient data for us to judge exactly on what principle it was worked out. In regard to the Parthenon, and some other Greek buildings, Mr. Watkiss Lloyd has worked out a very probable theory, which will be found stated in a paper in the "Transactions of the Institute of Architects." Vitruvius gives elaborate directions for the proportioning of the size of all the details in the various orders; and though we may doubt whether his system is really a correct representation of the Greek one, we can have no doubt that some such system was employed by them. Various theorists have endeavored to show that the system has pre-

that some such system was employed by them. Various theorists have endeavored to show that the system has prevailed of proportioning the principal heights and widths of buildings in accordance with geometrical figures, triangles of various angles especially; and very probably this system has from time to time been applied, in Gothic as well as in classical buildings. This idea is open to two criticisms, however. First, the facts and measurements which have been adduced in support of it, especially in regard to Gothic buildings, are commonly found on investigation to be only approximately true; the diagram of tigation to be only approximately true; the diagram of the section of the building has nearly always, according to my experience, to be "coaxed" a little in order to fit

the theory; or it is found that though the geometrical figure suggested corresponds exactly with some points on the plan or section, these are really of no more importance than other points which might just as well have been taken; the theorist draws our attention to those points in the the theorist draws our attention to those points in the building which correspond with his geometry, and leaves on one side those which do not. Now it may certainly be assumed that any builders intending to lay out a building on the basis of a geometrical figure would have done so with precise exactitude, and that they would have selected the most obviously important points of the plan or section for the geometrical spacing. In illustration of this point I have given (Fig. 25) a skeleton diagram of a Roman arch, supposed to be set out on a geometrical figure. The centre of the circle is on the intersection of lines connectcentre of the circle is on the intersection of lines connecting the outer projection of the main cornice with the perpendiculars from those points on the ground line. This point at the intersection is also the centre of the circle of the archway itself. But the upper part of the imaginary circle beyond cuts the middle of the attic cornice. If the arch was to be regarded as set out in reference to this circle, it should certainly have given the most important line, the top line, of the upper cornice, not an inferior and less important line; and that is pretty much the case with all these proportion theories (except in regard to Greek centre of the circle is on the intersection of lines connectall these proportion theories (except in regard to Greek Doric temples): they are right as to one or two points of the building, but break down when you attempt to apply them further. It is exceedingly probable that many of these apparent geometric coincidences really arise, quite these apparent geometric coincidences really arise, quite naturally, from the employment of some fixed measure of division in setting outbuildings. Thus, if an apartment of somewhere about 30x25 feet is to be set out the builder employing a foot measure naturally sets out exactly thirty feet one way and twenty-five feet the other way; it is easier and simpler to do so than to take chance fractional measurements. Then comes your geometrical theorist and observes that "the apartment is planned precisely in the proportion of six to five;" so it is, but is only the philosophy of the measuring-tape, after all. Secondly, it is a question whether the value of this geometrical basis is so great as has sometimes been argued, seeing that the results of it in most cases cannot be judged by the eye. If, for instance, the room we are in were nearly in the proportion of seven in length to five in width. I doubt whether any of us here could tell by looking at it whether it were truly so or not, or even, if it were a foot out one way or the other, in which direction the excess lay; and if this be the case the advantage of such a geometrical basis must be rather imaginary than real.

Having spoken of plan as the basis of design, I should wish to conclude this lecture by suggesting also, what has never to my knowledge been prominently brought forward,

that the plan itself, apart from any consideration of what we may build up upon it, is actually a form of artistic we may build up upon it, is actually a form of artistic thought, of architectural poetry, so to speak. If we take three such plans as those shown in Figs. 26, 27, and 28, typical forms respectively of the Egyptian, Greek, and Gothic plans, we certainly can distinguish a special imaginative feeling or tendency in each of them. In the Egyptian, which I have called the type of "mystery," the plan continually diminishes as we proceed inwards; in the third great compartment the columns are planted thick and close so as to leave no possibility of seeing through the building except along a single avenue of columns at a time: the gloom and mystery of a deep forest are in it, and the building except along a single avenue of columns at a time; the gloom and mystery of a deep forest are in it, and the plan finally ends, still lessening as it goes, in the small and presumably sacred apartment to which all this series of colonaded halls leads up. In the Greek plan there is neither climax nor anti-climax, only the picturesque feature of an exterior colonnade encircling the building and surrounding a single oblong compartment; it is a rationalistic plan, aiming neither at mystery nor aspiration. In the plan of Rheims (Fig. 28) we have the plan of climax or aspiration; as in the Egyptian, we approach the sacred portion through a long avenue of piers; but instead of narrowing, the plan extends as we approach the shrine. I think it will be recognized, putting aside all considerations of the style of the superstructure on these plans, that each of them in itself represents ure on these plans, that each of them in itself represents a distinct artistic conception. So in the plan of the Pantheon (Fig. 29), this entrance through a colonnaded porch into a vast circular compartment is in itself a great archimeration. tectural idea, independently of the manner in which it is

We may carry out this a little further by imagining a We may carry out this a little further by imagining a varied treatment on plan of a marked-out space of a certain size and proportion, on which a church of some kind, for instance, is to be placed. The simplest idea is to inclose it round with four walls as a parallelogram (Fig. 30), only thickening the walls where the weight of the roof-principals comes. But this is a plan without an idea in it; the central or sacred space at the end is not expressed in the plan, but is merely a railed off portion of the floor. plan, but is merely a railed off portion of the floor; the entrance is utterly without effect as well as without the entrance is utterly without effect as well as without shelter. If we lay out our plan as in Fig. 31, we see that there is now an idea in it. The two towers, as they must evidently be, form an advanced guard of the plan; the recessed central part connecting them gives an effective entrance to the interior; the arrangement in three aisles gives length, the apse at the end incloses and expresses the sacrarium, which is the climax and object of the plan. The shape of the ground, however, is not favorable to the employment of a long or avenue type of plan, it is too short and square; let us rather try a plan of the open-area order, such as Fig. 32. This is based on the short-armed Greek cross, with an open-centre area; again there is an "advanced guard" in the shape of an entrance block with a porch; and the three apses at the end give architectural

emphasis to the sacrarium. Figure 35 is another idea, the special object of which is to give an effect of contrast between the entrance, approached first through a colonnaded portico, then through an internal vestibule, lighted from above, and flanked by rows of small coupled columns: from above, and flanked by rows of small coupled columns; then through these colonnaded entrances, the inner one kept purposely rather dark, we come into an interior expanding in every direction; an effect of strong contrast and climax. If our plot of ground again be so situated that one angle of it is opposite the vista of two or more large streets, there and nowhere else will be the salient angle, so to speak, of the plan, and we can place there a circular porch—which may, it is evident, rise into a tower—and enter the interior at the angle instead of in the centre; not an effective manner of entering as a rule but ourse. not an effective manner of entering as a rule, but quite legitimate when there is an obvious motive for it in the legitimate when there is an obvious motive for it in the nature and position of the site. A new feature is here introduced in the circular colonnade dividing the interior into a central area and an aisle. Each of these plans might be susceptible of many different styles of architectural treatment; but quite independently of that, it will be recognized that each of them represents in itself a distinct idea or invention, a form of artistic arrangement of spaces, which is what "plan," in architectural sense, really means.

PROPOSED BRIDGE OVER THE HUDSON RIVER AT NEW YORK CITY.

As promised in our last issue, we give this week a view of the gigantic suspension bridge over the Hudson River, at New York City, proposed by Mr. Gustav Lindenthal, M. Am. Soc. C. E., and described by him in a paper read before the American Society of Civil Engineers on January 4, and of which we have already given some principal dimensions and leading features.

Further plans and particulars are withheld for the present at the special request of Mr. Lindenthal, so we would only add that there are to be four cables of straight wire of an effective diameter of about forty inches, those of the East River Bridge being something less than sixteen inches in diameter and the same number.

Views of some of the principal metal bridges of the world on the same scale are also given as affording an interesting comparison. They are all taken from the tracing accompanying Mr. Lindenthal's paper.

REPORT OF A SPECIAL COMMITTEE OF THE CHAMBER OF COMMERCE ON IMPROVE-MENT OF THE STREET PAVEMENTS IN THE BUSINESS PART OF THE CITY.

Unanimously adopted at a meeting of the Chamber, held January 5, 1888.

THE special committee appointed by the Chamber of Commerce of New York to confer with the authorities regarding pavements, to which reference has been made in our issue of December 17th, made the following report, which was unanimously adopted with thanks of the Chamber, and the committee continued:

"To the Chamber of Commerce:

"Your committee appointed for the purpose of endeavoring to secure improvement of the pavements in the business part of the city, respectfully report progress as fol-

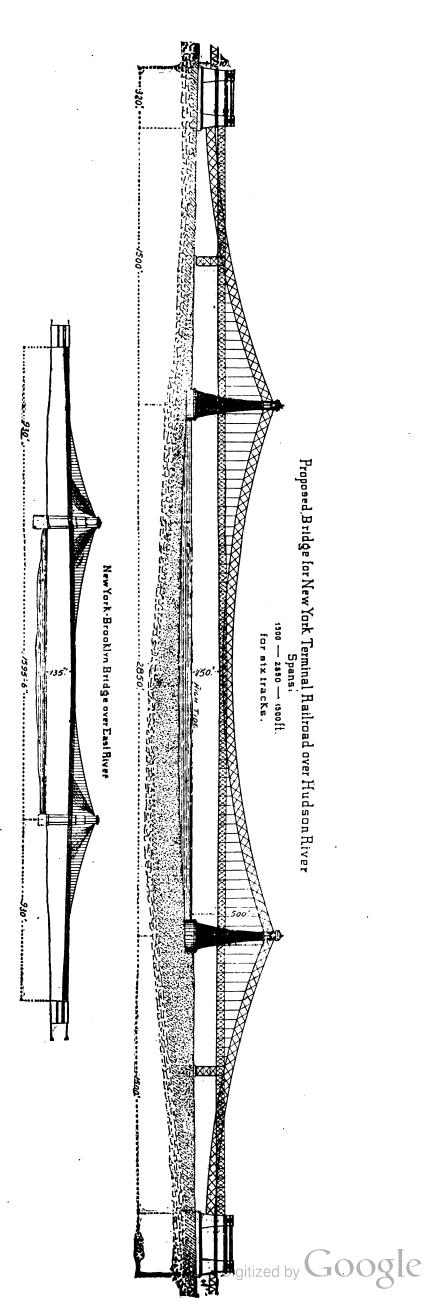
"That they have had an interview with his Honor. Mayor Hewitt, and the Commissioner of Public Works, General Newton; that both of these gentlemen appreciate the value to the whole city of efficient commercial facilities, manifested a hearty interest in the object, and promised all the co-operation in their power; that five hundred thousand dollars (the maximum amount at present permitted by law to be expended in one year by the city upon new pavements) has been appropriated by the Board of Estimate and Apportionment for that purpose, and that the Commissioner of Public Works has promised to confer with your committee regarding where and how this should be expended to obtain the best results.

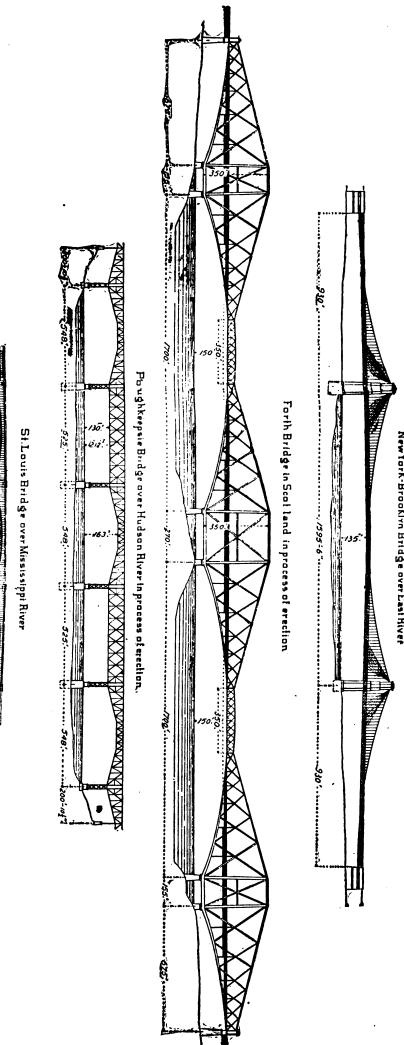
Your committee also had an interview with the officers of the Truckmen's Association, and believe that by a proper co-operation between merchants, truckmen, and other owners of horses and vehicles, results of very great value to the business and real estate interests of this city can, within a reasonable time, be attained. With the little investigation given this subject by your committee, the following facts are clear:

"First.—That our pavements in the business part of this city, upon which its earning power so much depends, are greatly inferior to those of other principal commercial cities of this and other countries with which we have to compete.

"Second.—That the expense of providing an intelligent system of pavements adapted to the heavier or lighter

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traffic of the various streets would be comparatively small in proportion to the benefits obtained. From three to five millions of dollars expended during the next three or four years would probably do all that is most needed. The interest on five millions of dollars, at the rate at which the city can borrow capital, would amount to from one hundred and fifty to two hundred thousand dollars annually. It is safe to say that the extra wear and tear upon horses and vehicles occasioned by our present bad pavements is far more than this sum, and this, in turn, is exceeded by the loss incurred through vehicles having to carry, upon the average, one-third smaller loads than they could carry with good pavement. When we add to this the great loss of time, occasioned by bad pavements, both in the movement of freight and of passengers, the aggregate is something

"Third.—It is evident that we must have better regulations governing the opening and replacing of pavements, which is constantly going on for gas, water, and steam connections and repairs, and the arrangement of railway tracks. Under the best municipal administrations of Europe, openings in the pavement are only made by the city authorities, or under their direction, upon the deposit of a sufficient amount to cover the expense of doing the work according to certain well-settled specifications. Street-railways are obliged to use grooved rails laid flush with the pavement, and in Liverpool street-railway tracks are owned and kept in repair by the city, which leases running privileges over them to the various street-car or tramway companies.

"The above regulations as to street openings are quite practicable here, and we propose to advocate such legislation as will give the Department of Public Works any additional authority necessary to that end. As regards our street railways, the city may not be able to own them, but we are assured that legislative authority unquestionably exists to regulate them, so as to compel a due regard for the public safety and convenience. The high centre-bearing rail now in general use by our streetrailways is an outrage upon the rights of other citizens. In the beginning many of the roads used a less objectionable rail; but with the design of making it difficult and dangerous for other vehicles to drive on this part of the street, or cross it, except at right angles, these high and dangerous rails have been introduced. The accidents, strain, and wear and tear to all vehicles have thereby been largely increased, and must necessarily increase with the constant increase of rail mileage. It certainly is not too much to ask from those citizens who have been given most valuable franchises, that they shall use a rail which experience in other cities has demonstrated can be laid without serious detriment to carriers or to the community. While this change cannot be made at once, and should only be made with due regard to the interests of the companies, as well as to those of the public, we recommend that the necessary legislation should be sought to compel such a change within a reasonable time, and that a conference should be had between repretime, and that a conterence should be had between representatives of this Chamber, the municipal authorities, the Truckmen's Association, and the railway companies, to agree, if possible, upon such legislation as will be fair to the public and to the railroads.

"This substitution of rails ought to take place simultaneously with the repavement of streets in which new pavements are to be laid, in order that they may be adjusted to each other.

each other.
"There are a considerable number of streets having a

"There are a considerable number of streets having a large and heavy traffic, which are not likely to be troubled with extensive openings for gas, steam, electricity, or water, which can with great advantage be repayed at once. It is upon such that the present available appropriation should be expended. During the present winter these can be decided upon, specifications can be drawn, and contracts let, so that contractors can make their preparations to execute their contracts during the months suitable for such work. With the experience thus obtained, if the Legislature should permit funds to be provided as above mentioned, much greater progress could be made during the year 1889. The present is a favorable time to make such improvements; materials are low and labor can be obtained at reasonable prices. We have an honest and be obtained at reasonable prices. We have an honest and capable administration of the departments of our city government connected with this work. This inspires government connected with this work. This inspires capital with confidence, and money can be borrowed at low rates to make these improvements, which would add immensely to the value and earning power of our city. We, therefore, recommend that these improvements should We, therefore, recommend that these improvements should be made as soon as possible, and that the requisite authority from the Legislature should be sought at the present session. His Honor, the Mayor, has offered to have a proper bill drawn by the Counsel to the Corporation, and, in the opinion of your committee, such a bill, and the other legislation above mentioned, will have a hearty support from the entire community."

NEW YORK STATE COMPETITION FOR MODEL COUNTRY SCHOOL-HOUSES.

AWARDS TO THE COMPETITORS.

SUPERINTENDENT OF PUBLIC INSTRUCTION DRAPER. of New York State, in September last invited plans in competition for prizes ranging from \$50 to \$150. The invitations for plans suggested six classes, ranging in price from \$600 to \$10,000 for buildings. Mr. Draper selected as the committee to pass upon the drawings and specifications these gentlemen: Ex-State Superintendent William B. Ruggles, Prof. J. W. Kimball, President of the State Teachers' Association; Superintendent Charles E. Gorton. President of the State Council of Superintendents: Principal E. H. Cook, of the Potsdam Normal School; Dr. George A. Bacon, representing the Associated Academic Principals; Willis R. Hall, School Commissioner of the Second District of Chenango County, and Mr. Albert W. Fuller, architect, of the city of Albany.

In his circular Superintendent Draper said: "The movement proposed has been undertaken in the hope that it will result in more attractive and comfortable low-priced school-houses in this State. For reasons which will appear obvious upon reflection there has heretofore been but little done in this direction. At the populous centres the buildings are generally fair, and when new ones are erected they are ordinarily very creditable. But outside of the large communities many of the buildings are truly wretched, erected without any idea of architectural effect, and entirely regardless of those matters upon which the health and comfort of the inmates mostly depend. Old buildings, in a shameful state of decay, are continued in use year after year. When new ones are erected it is considered unnecessary or too expensive to employ professional help, and so the best results are not secured.'

Fifty-eight designs were offered. Of these many were so defective in the matter of lighting, heating, ventilating, design, or general arrangement as to preclude the possibility of a favorable consideration. Of those which met with approval several were decided to be beyond the limit of cost, reckoning materials and labor at the lowest market prices. These plans could, therefore, receive neither prize nor honorable mention, which the committee deemed it was permitted to bestow only on designs strictly conforming to the letter of the instructions contained in Mr. Draper's circular. The prizes were awarded as follows:

Class 1-Six-hundred-dollar building-First prize to William P. Appleyard and Edwyn A. Bowd, of Lansing, Mich.; second prize to John R. Church, of Rochester, N. Y.

-One-thousand-dollar building-First prize to Class 2-William Appleyard and Edwyn A. Bowd, of Lansing, Mich.; second prize to John R. Church, Rochester.

Class 3-Fifteen-hundred-dollar building-First prize, J. C. A. Harriot & Co., Albany.

Class 4-Twenty-five-hundred-dollar building-First prize to William P. Appleyard and Edwyn A. Bowd, Lansing, Mich.; second prize to John R. Church, Roches-

Special commendations are made as follows:

Class 1-Six-hundred-dollar building-To John Cox, Jr., New York City.

Class 2.—One thousand-dollar building—To C. Powell Karr, New York City.

Class 3—Fifteen-hundred-dollar building—To Warren Briggs, Bridgeport, Conn.

-Twenty-five-hundred-dollar building — To

Class 4—Twen Warren R. Briggs. -Five-thousand-dollar building-To Warren R. Briggs, Bridgeport, Conn., and Fenimore C. Bates,

Cleveland, O. Class 6—Ten-thousand-dollar building—To Warren R. Briggs, Bridgeport, Conn., and Proudfoot & Bird, Wichita,

Kan.
Twenty-seven architects competed. No awards were made in class 5—five-thousand-dollar building—and class 6—ten-thousand-dollar building. It is proposed to have the successful plans photographed and available for all who desire copies.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

January 5, 1888.

To Members of the American Society of Civil Engineers: THE undersigned, members of the society, give notice that at the annual meeting on January 18, 1888, they propose to offer the following amendments to the "proposed amendments" to the constitution, for submission to the society. They request that all members who can possibly do so attend the annual meeting and vote upon these

amendments, and that members who cannot be present. send at once to the undersigned or to the secretary of the society, their views on the amendments, to be read in the discussion which will take place on this subject at the annual meeting, and be printed for the information of members-J. J. R. Croes, William R. Hutton, J. F. Flagg, G. Lindenthal, C. C. Schneider, James Archbald.

Amendment as originally offered: (1) Amend Article XVI, of the Constitution by substituting for the present article the following: Constitution. Article XVI, The active members of the society shall be divided into three active members of the society shall be divided into three classes, to be styled respectively members, associate members, and associates, and each person, when duly elected and qualified, shall receive a certificate of membership indicative of the class to which he belongs. Associate numbers shall have all the rights and privileges of members excepting the right to hold office or to vote upon admission to membership or changes in the constitution. admission to membership or changes in the constitution and by-laws of the society. Associates shall have all the rights and privileges of members excepting the right to hold office or to vote. There shall also be a preparatory grade, to be designated students of the society, who shall have the right to receive the transactions of the society and to present papers and written discussions. They shall also have the right to use the library and rooms of the society, and to attend its meetings subject to such regulations and restrictions as the Board of Direction may adopt. Members of the class previously designed admission to membership or changes in the constition may adopt. Members of the class previously designed juniors shall, after March 7, 1888, be classed as associate members.

Proposed amendment of above: Strike out entirely the clause in italics. This society is not an institution for primary education, but is intended to be an association of killed and experienced engineers for mutual improvement by the interchange of ideas and experience of a character more advanced than can be fully understood by novices in the professional work. Admission to any grade of mem-bership should be contingent on experience had and work accomplished and not on the mere desire to learn and the

hope of future benefit by association. Amendment as originally offered: (2) Amend Article XVII. of the Constitution by substituting for the present article the following: Article XVII. A member shall be a civil, military, mining or mechanical engineer, not less than thirty years of age who has been in active practice as such for at least ten years, or has graduated at a school of programs and then in practice as years, and who has such for at least ten years, or has graduated at a school of engineering and been in practice seven years, and who has had responsible charge of work as chief, resident, or superintending engineer for at least two years, not as a skillful workman merely, but as one qualified to design as well as to direct engineering works. An associate member shall be one not less than twenty-four years of age, who has had actual practice in some of the branches of civil, willtary, mining or mechanical engineering for at least five. military, mining or mechanical engineering for at least five years, or has graduated at a school of engineering and been in practice two years and who continues in actual practice at the time of his application for membership. An associate shall be one not less than twenty-five years An associate shall be one not less than twenty-hve years of age, who is a manager of a railroad, canal or other public work; a geologist, chemist or mathematician; a proprietor or manager of a mine or metallurgical works; an architect or a manufacturer; or one who, from his scientific acquirements or practical experience, has attained eminence in his special pursuit, qualifying him to co-operate with engineers in the advancement of professional knowledges. edge; but shall not himself be practicing as an engineer. A student shall be one not less than eighteen, nor more than twenty-seven years of age, who is engaged in the study of engineering with the intent to become an engineer, and who has pursued that study at a technical school not less than one year, or who shall have been engaged in the study and practice of engineering under a competent engineer for not less than two years. A student shall not remain in that grade for more than seven years; if not elected to a higher grade his connection with the society shall terminate at the end of seven years, or upon his attaining the age of twentyseven years.

Proposed amendment of above: Strike out last clause in reference to students for reasons given above. Amend the rest of the article so that it will read as follows: "Article XVII. A member shall be a civil engineer, not less than 30 years of age, who has been in active practice in hydraulic, railroad, mechanical, mining, electrical, topographical, hydrographical, sanitary or military engineering for at least ten years, or has graduated at a school of engineering and been in practice eight years, and who has had responsible charge of work as chief or superintending engineer for at least two years, not as a skillful workman merely, but as one qualified to design as well as to direct engineering works. An associate member shall be one not less than 24 years of age, who has had actual practice in some of the branches of civil engineering for at least five years, or has graduated at a school of engineering and been in practice three years and who continues in actual practice at the time of his application for member-Proposed amendment of above: Strike out last clause actual practice at the time of his application for membership. An associate shall be one not less than 25 years of ship. An associate shall be one not less than 25 years age, who, from his scientific acquirements or practical experience, has attained eminence in his special pursuit, the co-operate with engineers in the perience, has attained eminence in his special pursuit, qualifying him to co-operate with engineers in the advancement of professional knowledge, but shall not be practicing as a civil engineer." (1) The "civil engineer" includes all branches of engineering work. (2) The full period of study at a preparatory school should not be considered as equivalent to the same period of actual practice in the profession.

In the succeeding amendments strike out all clauses re-

In the succeeding amendments strike out all clauses re-lating to the grade of student,



lite.



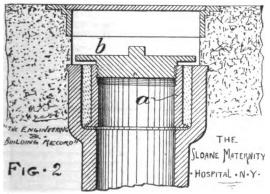
PLUMBING IN THE SLOANE MATERNITY HOSPITAL, NEW YORK.

This building, the gift of Mrs. W. D. Sloane, of New York, is situated on a large plot of ground within which and connecting with it are the College of Physicians and Surgeons and the Vanderbilt Clinic. Each building is isolated and all of the rooms are therefore well supplied with both light and pure air. The material used in constructing the exterior of these buildings is of brick, with terra-cotta trimmings and granite sills and lintels.

The main entrance to Maternity Hospital is from Fiftyninth Street, and the vestibule of this entrance has a wainscot of marble and floor surfaced with the same material. The wainscot in hall on first floor is marble, with white tile surface for floor. The stairs leading to each story have a frame-work of iron, with a tread of slate. The wood trimmings throughout the building are Georgia pine, finished in oil and varnished; but the walls and ceiling have a plain white finish.

The building is heated with steam, which is obtained from the plant located in the college building. Every part of this structure has been built in a thorough, substantial manner.

It is three stories in height, with an attic and basement. There are bath-tubs located on each floor, and all are porcelain, except one in the attic, which is iron, enameled. The laundry-tubs, which are in the basement, and the slop-sinks on each floor above are also porcelain. The basement is accessible from the main floor by a flight of steps within the building, and also by another flight leading direct from sidewalk on Tenth Avenue to basement hall.

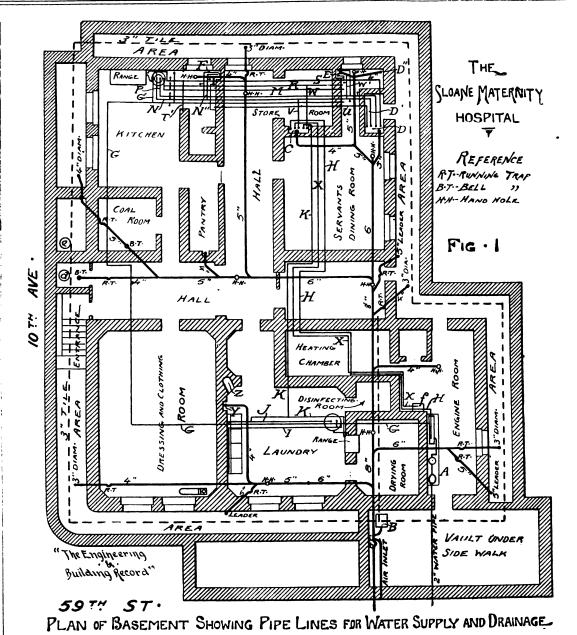


DETAIL OF HAND HOLE COVER FOR SOIL PIPE

A plan of the basement story is shown in Fig. 1. On this floor is located the kitchen, laundry, dressing and clothing room, servants' dining-room, a drying-room, and a disinfecting-room. The kitchen has a wainscot of white-glazed tile, which extends up to the bottom of the windows, and a floor of white unglazed tile laid on concrete. The entire floor in the basement, except the part occupied by kitchen, is constructed of concrete and surfaced with asphalt. The wainscot in the laundry, dressing and clothing room, and servants' dining-room is composed of sand and Portland cement, laid on three-quarters of an inch thick.

An area extends around the entire building, as shown in Fig. 1. This area at the front entrance on Fifty ninth Street, and also at d and e on Tenth Avenue, is covered. All barrels and boxes containing supplies for kitchen and laundry are received through an opening in covered area at d and coal through a similar opening at e. At Z in Figs. 1 and 5 the position of a circular tube or chute 16 inches in diameter is shown. This chute communicates with the hall on second and third floors, with openings protected by iron doors, as shown in Fig. 5; and through these openings all soiled clothing intended for the laundry will be deposited inclosed in bags and passed down to laundry, thereby saving much time and labor that would be necessary if carried down the stairs.

Any clothing that may require disinfecting will then be placed in the disinfecting-room, shown in Fig. 1, where a high degree of heat can be obtained by means of large coils of steam-pires.



The laundry-range shown in Fig. 5 is covered with a shield of galvanized iron which is made in two sections. The rear portion is stationary, but the front can be pushed up or down by means of the handle shown at B'. The position of this shield is indicated by the curved broken lines, but the rear, shown by broken vertical lines, is open, and when shield is turned down the heat from this range is forced into the clothes-drying room shown in Fig. 1.

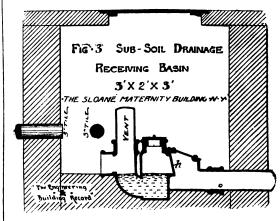
In order to facilitate the motion of the movable section of the shield, two weights are attached, connected with it by means of chains passing over pulleys as shown at L' in Fig. 5. These weights are inclosed in tubes made of galvanized iron, indicated by broken vertical lines surrounding the weight L'. The copper clothes-boiler O sets in the range and is connected with smoke-flue 1' by means of a brass pipe in which is set a valve. This pipe can be utilized for removing any surplus steam from the clothesboiler. A faucet is set in clothes-boiler for the purpose of draining off water. If this device for generating heat in the drying-room be insufficient for drying purposes that will be required in an institution of this character, coils of steam-pipes can be laid in this room and connected with the heating system, permitting steam to be utilized for drying purposes.

In Fig. 1 the heavy black lines show the position of soil-pipes, and light lines the pipes for water-supply. The soil-pipes are laid 18 inches or more below the surface of the floor, and are made of cast iron, extra heavy. Handholes are located at convenient points on the soil-pipe as shown in Fig. 1, and marked H H. also represented by a detail section in Fig. 2. These handholes are intended to facilitate the removal of obstructions from the pipe should any occur. A T-branch is set in the pipe vertically, and extended up near surface of floor, terminating with a hub. A brass sleeve is then set as shown in Fig. 2, secured by a lead joint, and in this sleeve is fitted a brass cover b, having a screw-joint. This cover can be removed easily whenever required by means of a wrench applied to the nipple shown. An ordinacy iron street-washer cover is

set in the concrete over it flush with floor, permitting access to handhole at any time.

The main soil-pipe, shown in Fig. 1, is eight inches in diameter from sewer to hall at centre of building, and there reduces to six inches, at which size it continues nearly through dining-room, thence by a 5-inch branch to recess D and extends vertically up to roof, with branches on first, second and third floors to toilet-basins and sinks.

Another branch runs to recess E, thence vertically to roof, with branches on first, second and third floors to water-closets, baths and sinks and to bath in attic. A third branch runs to recess C, where a 3-inch vent-pipe is



carried to roof. A servants' water-closet is located in basement, at D', and an engineers' water-closet, at D.'

A branch runs through laundry and dressing-room to which all waste-pipes in these rooms are connected. A line extends also from this pipe to recess, Y; thence a 3-inch vent-pipe is carried to roof. A water-closet and porcelain bath is located in dressing-room.

A branch in hall runs to the left the entire length of hall to vault, at d, terminating in a bell-trap, Another branch runs to recess in pantry, where a 3-inch vent extends to

Digitized by GOOGLE

roof. A branch runs through hall to recess F in kitchen, and thence up to second floor, to which waste-pipes from kitchen-sink and slop-sinks on first and second floors are connected. Branches extend to four leaders and also to five area-drains, which are shown in Fig. 1.

The lines of tile for subsoil drainage, shown by broken lines, extend under the area floor around the entire building, and there is also a line laid parallel with 8-inch pipe; all discharge into basin B. This receiving-basin is connected with soil pipe through a back-water trap, the arrangement being shown in detail by Fig. 3. The flapvalve h in this sketch is intended to seal the basin against any back flow from soil-pipe. This trap is ventilated. A movable plate, secured by bolts, is set over valve described, giving access to valve whenever required. A handhole is shown in the top of trap, having a cover similar to that shown in Fig. 2.

All pipes for water-supply are made of galvanized iron. The intake for water-supply is shown in Fig. 4. This intake rests on a foundation of brick 15 1/2 inches high and capped with bluestone four inches thick. The main pipe from Fifty-ninth Street to the air-chamber is two inches in diameter, the meter being set close to the wall. The lowpressure supply flows into air-chamber, thence into pipe

I-beams. This tank is made of boiler iron, the dimensions being eight feet eight inches by eight feet, and five feet four inches in height, containing 2,630 gallons.

(TO BE CONTINUED.)

NOT A CLOSED TANK, BUT CAREFUL PIP-ING IS NEEDED FOR HOT-WATER RADIATORS BELOW THE BOILER.

BANGOR, ME., December 6, 1887. SIR: Will you explain through your paper why it is that hot-water radiators or pipes below the boiler are supposed to work better under a pressure tank than when the ratus has the common open tank usually furnished?

Yours truly, . Р. Т.

[We are not aware that such is the case, nor do we think the question of open or closed tank has anything to do with the circulation in pipes below or above the boiler.

Of course, pipes or radiators below the boiler rarely or never do as well as those above the boiler. By setting them with care, and using very large sized flow and return pipes with the fewest number of elbows and no unvented air-pockets, they may work if not too much below To insure a coil's working in such a case, the boiler.

radiator below the boiler the circulative force lies in the up and down legs of the flow-pipe, or rather in the difference between the densities of the water contained in them, and therefore, if the extra weight caused by the rise in the cold return-pipe does not outweigh this difference there will be a circulation in the right direction. Its velocity will depend on carrying the flow-pipe high up and then down, on having all the pipes large in diameter, on having long and easy bends, and on having the coil or radiator not too far below the boiler. It will also be helped by having the up leg well felted and the down leg exposed as much as possible.

Pipes from the same boiler may run to the upper part of the house, with an open tank.]

FIRST REPORT OF THE BOARD OF ELEC. TRICAL CONTROL FOR THE CITY OF NEW YORK.

THE following is an abstract of this report, adopted January 6, 1888, and addressed to the Governor and Legislature of the State, to which is added an abstract of the

The total length of trench excavated for the laying of subways since July, 1887, is 189,918 feet.

The total construction of single duct for telephone and telegraph service is 903,180 feet, to which must be added 4,050 feet for distributing-service and connections to censtations.

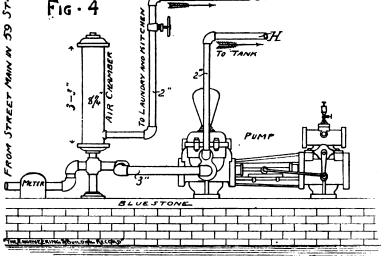
Estimating 80 wires per single duct, the total capacity for telegraph and telephone service is 72,254,400 feet, or about 13,700 miles, of wire.

The total construction of single duct conduit for arclighting and power service is 254, 250 feet, and the capacity of this conduit may be estimated as sufficient for 2,542.500 feet, or nearly 500 miles, of wire.

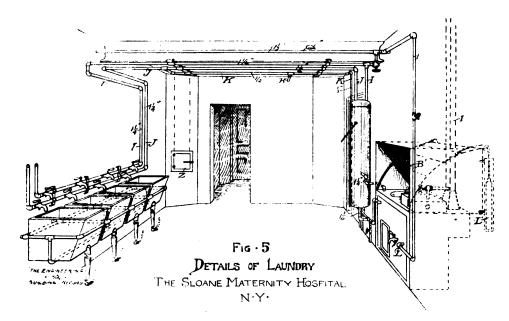
In addition to the above the number of feet of conduit for incandescent lighting is 186,745, containing 500,235 feet of conductors

feet of conductors

The capacity of conduit provided in the city of New York during the existence of the Board of Electrical Control is therefore considerably greater than there is in an city in the world, so far as the information of the Board extends; and notwithstanding the great difficulties which surround this whole subject in this city, which has a greater mileage of wire than any other, and where the cir-



·DETAILS OF INTAKE FOR WATER SUPPLY · SLOANE MATERNITY HOSPITAL · N.Y.



G to laundry and through dressing-room to kitchen, and through storeroom, terminating in a hall at the rear of the servants' dining-room. The course of this pipe can be traced in Fig. 1. Branches from G connect with boilers in laundry and kitchen.

The tank or high-pressure supply is carried from airchamber through a 3-inch pipe to a Davidson pump, which forces supply to tank through pipe H. The direction of the pipe H, which is two inches in diameter, is shown in Fig. 1. This pipe passes from engine-room through heating-chamber and servants' dining-room to recess C, thence up to tank. The tell-tale pipe X runs parallel with H from tank to engine-room, discharging into sink f.

The tank is located in the attic or fourth floor, and is elevated about 21/2 feet above the floor, supported on

however, it must be of large diameter its whole length, and the flow and the return pipes must be no smaller than the

When a coil is set as low or a little lower than the boilersay on the floor-you will not get it to work unless you run its flow or supply connection to the ceiling, or as much higher as possible, and there make an air-pocket, with aircock at the highest point; then run from this air-pocket, which some may mistake for a closed tank, to the coil, with such grades that any air that cannot get through to the boiler can return to the air-pocket above. If you use a radiator in such a place drill out its ends to 11/2 or 2 inches, according to its size, and use correspondingly large flow and return, and it will work if not too low down. It must be remembered that with a coil or



cumstances of underground construction are as difficult as in any other, the conversion of the present overhead to an underground system is a fact about to be accomplished to a very great extent at least, in the near future.

Already the Western Union Telegraph Company is

occupying the conduits which have been constructed, with some five hundred miles of wire. The Metropolitan Telephone and Telegraph Co. has some one thousand miles of wire in the subways; and the Edison Illuminating Com pany, whose conductors were laid in the trench at the time of construction, has, as has already been said. more than one hundred miles underground.

The poles and wires removed from the surface of the streets as a result of the work of the Board is as follows:

217 poles and about 500 miles of wire.

The overhead telegraph and telephone services are, except in the case of fires, of very little danger; and, in



the main, wires devoted to this service are in good con-

dition.

The overhead electric-light conductors, however, are very dangerous both to life and property whenever improperly insulated; and improper insulation of these dangerous and deadly wires is to be found almost everywhere throughout the city.

The chief provisions of the Board of Underwriters are to the effect that the electric-light wires must be of the kind known as "underwriter's wire," and that they must not in any case be carried over buildings.

"Underwriter's wire" is a wire covered with a tape saturated with white lead, and a certain length of usage renders it susceptible to moisture. After being in use still longer the tape rots away and leaves the naked wire exposed.

in many places in the city of New York electric light and power wires are carried dangerously near buildings, awnings, telegraph and other poles, lamp-posts and other street obstructions.

Again, in many parts of this city several distinct lines of poles carrying electric-light conductors are to be found on the same side of the same street, and as these poles necessarily differ in height the wires upon them form a complete network, rendering the efficient use of the hooks and ladders and life-saving apparatus of the Fire Department almost impossible.

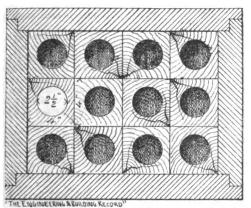


FIG.2 CROSS SECTION



ELEVATION

FIG. 3 DETAILS OF SINGLE DUCT

Again, a nuisance has been created by the fact that companies having contracts to light the city by electric-light are allowed to own the lamp-posts they use, which necessitates frequent tearing up of the pavements when any new contracts are awarded.

In inaugurating the underground system the Commis-sion has followed certain principles, which may be defined as follows:

First.—A conduit or subway for electrical conductors is nothing more than a mechanical protection for the wires within it, and a convenience for placing and protecting them underground.

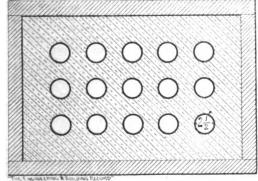


Fig. 4

Second.—Electric light and power conductors should, as a matter of precaution, if not of necessity, be operated separately, and as far as possible from those for the transmission of currents of lesser intensity.

Third.—The material and form of the subway should depend largely upon the requirements of the locality and the service for which it is designed.

Fourth.—Drawing-in-and-out conduits with convenient manholes are, in the main, the most desirable for the streets of this city, where a condition of the law allowing the companies ninety days to place their conductors in the subways after they are constructed, necessitates that the subways shall be easily accessible without serious disturbance of the pavement.

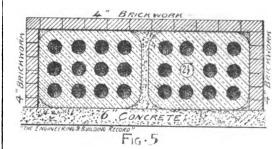
Fifth.—The success of the underground service de pends largely upon the proper insulation of the wires, and the largest liberty compatible with the preservation of the rights of others should be allowed to the companies making the state of the state ing use of the subways.

Sixth.—The nature of local connections depends to a great extent upon the service and locality for which they are designed, and here again liberty of choice under proper restrictions may reasonably be allowed.

Proceeding from these general principles, the board has constructed subways in different localities largely differing in design, size, and material

constructed subways in different localities largely differing in design, size, and material.

The subways, however, with the exception of the construction for the Edison incandescent plant, are all on the drawing-in-and-out pattern, which means a tube or series of tubes or ducts through which cables or insulated wires can be drawn, terminating at distances of about 200 feet in boxes or manoles, to which access can be had from the street by removing an iron cover.



The liberality which the Commission has seen fit to exercise in the matter of additions to the conduits for the purpose of making local connections, allowing the construction company to furnish whatever the several com-panies desire for themselves from the manhole to the points desired to be reached, has been taken advantage of

and promises beneficial results.

For example: the construction company has, at least in one instance, employed the hand-hole system of distribu-tion for the use of the telephone wires in down-town streets where it seemed desirable, while at other points a single entrance into a block in connection with house-top distribution has proved efficient.

A system of inspection of the subways and the wires within them, and their maintenance free from moisture and gases, is another duty to which the board is giving its attention.

APPENDIX.

Regulations in regard to overhead wires.

I. No two lines of poles shall be on the same side of any street or avenue.

II. No two lines of poles bearing conductors or similar electrical service shall be on any street or avenue.

III. Electric light poles shall be of iron, at least twentyfive feet in height with a diameter of not more than eight inches at the base, and having cross-arms of wood, with glass, porcelain or rubber insulators, and painted a

. IV. Poles for telegraph, telephone and other similar wires shall be at least sixty feet in height.

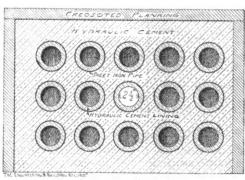


Fig. 6

V. Poles shall be placed upon the sidewalk as near the curb as possible, and no pole shall be placed within ten feet of any lamp-post or other pole.

VI. All existing regulations of the local authorities in regard to the placing of poles and stringing of wires are to continue in force.

VII. All wires shall be fastened upon poles or other fixtures with glass, porcelain or rubber insulators.
VIII. No wires shall be stretched within one foot of any

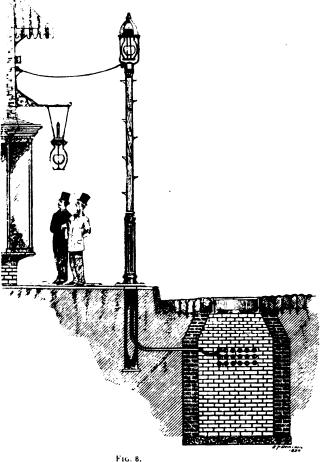
pole without being attached to the same with glass, porce lain or rubber insulation.

IX. No wires shall be stretched within twenty feet of the ground or within four feet of any building except when attached thereto with glass, rubber or porcelain insulators.

X. No arc electric light or power wires shall be stretched over any part of any house or other building.

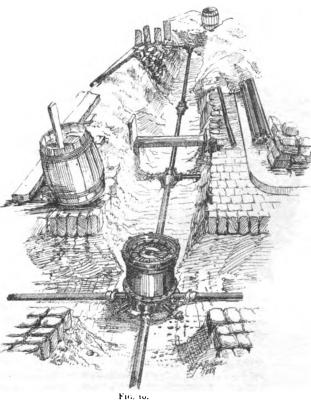
The following are some of the additions that have been suggested by Park Benjamin, Ph. D., to the rules and regulations governing the occupancy of the subways:

All conductors drawn into and operated in the conduit, and intended to convey currents of an electro-motive force exceeding fifty (50) volts, shall have an initial insulation resistance of not less than fifteen meg-ohms, per mile, per one hundred volts electro-motive force of current in the circuit. Whenever the insulation resistance of a conductor as aforesaid shall prove to be less than five (5) meg-ohms, per mile, per one hundred volts, the use of that conductor shall at once cease, unless the actual electro-motive force in its circuit be reduced so as to reestablish the foregoing ratio. establish the foregoing ratio.



The insulation resistance per mile length of all branches and feeders of the main conductors shall at least equal that of the respective conductors to which said branches and feeders are connected.

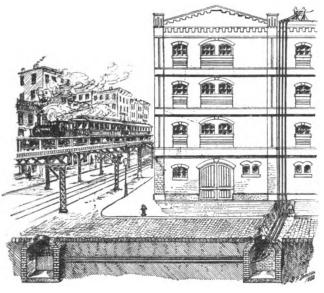
The insulation resistance of each length of cable or conductor shall be determined before said length is laid in the subway. In making this determination an electro-



motive force of current of not less than one hundred and fifty volts shall be employed, and the minimum initial resistance as provided in Rule 4 shall not be diminished through and after an immersion of the conductor under test of at least sixty consecutive hours. All lines shall be tested for insulation resistance immediately after comple-



tion in the subway, and daily thereafter for a period of one month, and thereafter at least weekly. A conductor shall be tested for insulation immediately after any new connection with, addition, or repair to, or alteration of any sort, in said conductor is made, and also whenever any other conductor is placed in the same tube; conductors conveying currents of less than fifty (50) volts electromotive force are excepted from this rule.



The work of the Board of Electrical Control has been done under the direction of its Chief Engineer, Mr. Henry S. Kearny, by a construction company known as the Consolidated Telegraph and Electrical Subway Company, of which Leonard F. Beckwith is Chief Engineer and Mr. Joseph P. Davis is Consulting Engineer. The completed conduits are the property of the construction company and he right to their use is leased by it to the various telegraph, telephone, and electric-light companies.

DESCRIPTION OF ILLUSTRATIONS.

It will be understood that for convenience of construction, and, still more, for convenience of cleaning the conduits and drawing the cables through them, they must be practically straight between manholes, shown in Figs. 1, 7, and 8, which, therefore, are required at all angles and offsets either of grade or alignment and at all branches. This necessitates a great many of them, for while a cable

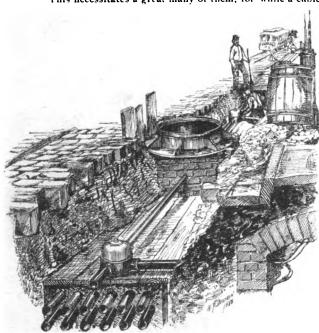


Fig. 9

can be readily drawn through 600 feet of straight conduit, manholes at street crossings have sometimes to be within 30 feet of each other.

This sufficiently explains Fig. 1. The cable that the man is pulling down from above is being hauled into the conduit. Figure 7 shows branch from main subway for house-top distribution through a block. Figure 8 shows branch from subway for electric lighting. Figure 9 shows subway in course of construction, with manhole opening and exposed ends of conduits. The single conduit on top is for distribution between manholes. Some wires are shown entering the vault on the right from the service-box in the foreground. Figure 10 shows the conduits of the Edison Electric Light Company, with junction-box in the foreground and service and joint boxes beyond.

Figures 2, 4, 5, and 6 are typical conduit sections. Figure 2 is made with creosoted wooden tubes in creosoted wooden casing, and Fig. 3 is a detail of the connection between two tubes. Figure 4 shows wrought-iron pipes laid in asphaltic concrete, with creosoted wooden box. It may also show wrought-iron or sheet-zinc tubes bedded in hydraulic cement concrete and cased with creosoted plank, but when hydraulic cement concrete is used the bottom layer of plank is omitted.

Figure 5 is a conduit made with Dorsett coal tar composition blocks bedded on concrete and covered with brick. The conduit in Fig. 6 is made of cement-lined sheet-iron pipe laid in hydraulic cement concrete and cased with creosoted plank. Between eighty and ninety per cent. of all the conduits have been laid with screwed wrought-iron pipe, laid in hydraulic cement concrete, and about twenty per cent. of the conduits are three inches internal diameter. Most of the balance are 21/2-inch as

We are indebted to Mr. William J. Sefton, Secretary of the Construction Company, for the electrotypes for Figs. 7, 8, 9, and 10, and, also, to Messrs. Kearney, Beckwith, and Davis for much valuable and interesting information.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company. Equitable	Company.
January 7	24.18	18.55	20.68	30.89	28.76	24 60 29	.82

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

WHAT CITIES IN THE UNITED STATES USE GARBAGE-CREMATING FURNACES?

PATERSON, N. J., January 7, 1888.

SIR. Can you give me a list of cities in the United having garbage-burning furnaces?
WILLIAM K. NEWTON, Health Officer.

Referred to our readers for definite information.

We occasionally see newspaper items to the effect that a certain city has decided to cremate its garbage, but we do not recall any official statements regarding the actual existence of any such cremators in any large city in the United States-Montreal, Can., being the last city thus referred to. The garbage and refuse at the military post at Governor's Island, N.Y., is, however, all disposed of in this way. An illustrated description of the cremating plant will be found in Vol. XII., of this journal, page 211.]

CAN THE ELEVATED ROADS BE OPERATED WITH LESS NOISE?

THE following communication from a gentleman of very large experience in L-road construction is partly in reference to the complaint of our correspondent "Knickerbocker" under the above heading in our issue of December 31, and partly in answer to a private note addressed him on the same subject, which will account for the reference to Trautwine, who says, page 391 of the old edition of "Trautwine's Pocket-Book": "It is a remarkable fact, not satisfactorily accounted for, that when lengths of from 100 yards to some miles of rails have been perfectly welded or riveted together tightly, and spiked to the ties as usual, no elongation or contraction by heat or cold could be detected." Obviously, if this could be safely done all the noise due to the hammering of wheels on rail-joints would be eliminated, and this, especially on an elevated road, constitutes more than three-fourths of the noise due to a moving train. An oblique joint has been tried on some portions of the Elevated Road, but with only partial success.—ED.]

HARRISBURG, December 26, 1887.

SIR: The "puffing" of the engines being due -i. ϵ ., its excessive amount—to slack joints, etc., is remediable by attention to the leaks, slacks, lost motion, etc., causing or necessitating it. But some puff, of course, must needs be.

The rolling sounds also must remain whatever the motive power. In view of the accidents which have befallen in consequence of expansion of "butting rails," I think Mr. Trautwine's line long rail were a perilous venture. The only effectual remedy for your complainant seems to be with peighborhood.

PROPOSED BRIDGE OVER THE HUDSON RIVER AT NEW YORK CITY.

SINCE the previous article under this heading was in type, we have received at the last moment the following from Mr. Gustav Lindenthal:

The proposed North River Bridge is for six railroad tracks on a floor platform eighty-six feet wide (same as East River Bridge); clear height at middle of river, 145 feet above high tide at 50° Fah. temperature (the floor would sink four feet in summer and rise the same about in winter). Length of middle span, 2,850 feet, to centres of towers, each pier within the legal pier-line to centres of towers, each pier within the legal pier-line of each shore. The end spans are about 1,500 feet long each, and the total length between anchorages is 6,500 feet, including anchorages. The height of metal towers to lower cable is 400 feet; to top, 500 feet, which stand on masonry piers 340x180 feet respectively and are nearly 75 and 180 feet deep.

The anchorages are each about 320 feet long and 180 feet wide and are 210 feet above the pavement. The six

feet wide and are 210 feet above the pavement. The six railroad tracks pass through a tunnel in each anchorage

The type of the bridge is that of two suspended huge arch-ribs (or braced arches) supported on steel or wrought towers of great stability, from which they descend back to the large anchorages, which resist the pull from the large arch-cables. The latter are 50 feet apart, strongly braced together, to resist the deforming effects of passing Each cable has an outside diameter of four feet and will have the smooth cylindrical appearence of a huge bent metal shaft.

The cables are inclined towards each other, or "cradled," one foot in ten. From them are suspended the platform and the trusses, between which the six tracks are placed. Four wind-cables of 12½ inches diameter are in two horizontal planes, securing the lateral stability of the superstructure.

The towers are strongly braced inside with heavy mem-

bers, and on outside with large-sized lattice-filling between the curved columns. On top the arches are held apart by a heavy cross-bracing. The towers are connected at the top and bottom into one coherent structure. The towers are connected solid

The architectural features of the bridge were considered of the highest importance and were sought to be obtained in a natural manner without attempts at ornamentation.

The bridge is to be proportioned for six heavy trains, 1,500 feet long each, drawn by two of the heaviest known engines. It is not likely that six such trains would meet on the bridge in a lifetime. Ordinarily the loads will only be a small fraction of the assumed maximum.

The bridge will be proportioned against a wind pressure of fifty pounds per square foot on all exposed surfaces. The principal provision for it are are two wind-trusses (forming the top and bottom of suspended track platform) combined with four wind-cables, each 12½ inches diameter and kept under constant tension by a lever arrangement in towers.

Each cable is surrounded with a steel mantle one-eighth of an inch thick, leaving an air-space between it and the wire cable inside. All connections with web members will be adjustable during and after erection, so that both cables shall be equally strained from the uniform loads of the superstructure at a middle temperature.

Cost of bridge alone, about \$15,000,000. Time of building, three and a half years.

A bridge with a middle pier would be more expensive

on account of depth of foundation and the impracticability of using wire cables for more than one middle span. The

great strength of wire as compared with metal in link-cables makes the longer span bridge cheaper.

The rigidity of the bridge will be such that all trains will be able to cross it at fast speeds (same as on solid ground) without causing any discernible oscillation.

CONNECTICUT CIVIL ENGINEERS' ASSO-CIATION.

AT the annual meeting the following officers were elected: President, C. H. Bunce, of Hartford; First Vice-President, F. F. Weld, of Waterbury; Second Vice-President, William B. Palmer, of Bridgeport; Secretary and Treasurer, D. S. Brinsmade, of Birmingham: Assistant Secretary, E. P. Augur, of Middletown. Executive Committee: C. H. Bunce, of Hartford; B. H. Hull, of Bridgeport; E. P. Augur, of Middletown; C. M. Jarvis, of Berlin; C. E. Chandler, of Norwich.

The president's address was read by Mr. C. E. Chandler, of Norwich

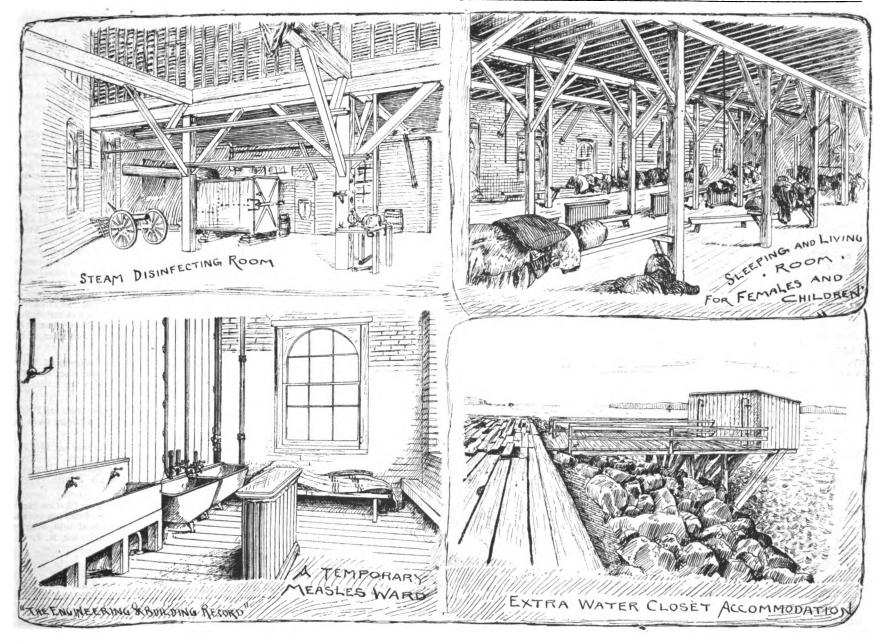
of Norwich.

A paper was read by E. P. Augur, City Engineer, of Middletown, describing the adjustable effluent pipe of the Middletown reservoir, which was illustrated by blue prints. The discussion of the rental value of hydrant service was continued.

F. B. Durfey, of Norwich, read a paper describing the new water-works at Bath, Me., built by him as contractor, after designs by J. Herbert Shedd, C. E. The filtering gallery was a novelty to most of the members present. It consists of about 125 feet of 15-inch Akron pipe, 400 feet of 12 inch, 50 feet of 8-inch, and 800 feet of 4-inch pipe.



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A STATE QUARANTINE ESTABLISHMENT. PORT OF NEW YORK, DECEMBER, 1887. VIEWS ON HOFFMAN ISLAND.

Drawn from Photographs.

laid about four feet under the bed of a fresh-water pond from which the water filters through a gravel filling and runs through the above pipes to a pump-well, from which it is pumped to a tank, the top of which is 250 feet above

tide water.

Papers were also read by F. W. Whitlock, Assistant City Engineer of Waterbury, on "Co-ordinate Surveying and Plotting," and T. H. McKenzie, Engineer of the Southington Water-Works, on "Mason-Work." The latter paper elicited a long and interesting discussion on the classification of stone masonry.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.

SURVEYORS.

THE third annual meeting of the Illinois Society of Engineers and Surveyors will be held in the State House at Springfield, commencing Wednesday evening. January 25, and continuing January 26 and 27.

The following papers will be presented: "President's Address," Prof. I. O. Baker; "Bridges and Viaducts for Cities," D. W. Mead, City Engineer, Rockford; "Laying out Towns, and Monuments for Cities, etc.," Prof. T. C. McClanahan, Monmouth; "Highway Bridges," J. O. Wright, Gilman; "Mine Surveying," F. V. Alkire, Petersburg; "Surveying, Practical and Artistic," D. L. Braucher, Civil Engineer, Lincoln; "Culvert at Nichols' Hollow," E. A. Hill, Acting Chief Engineer I., D. & S. R. R., Indianapolis, Ind.; "Specifications for Bridge Iron," Prof. I. O. Baker, University of Illinois; "Mining Engineering Topic," A. C. Braucher, Mining Engineer, Raton, New Mexico; "Bridge over the Ohio River at Cairo," S. F. Balcom, Assistant Engineer, I. C. R. R., Champaign: "Village Plats," Z. A. Enos, Springfield; "Artesian Wells," Prof. T. B. Comstock, University of Illinois; "Importance of Replacing Wooden Trestles with Iron and Stone Structures," J. M. Healy, Division Engineer, I. C. R. R., Champaign; "Highway Bridges," P. E. Lane, Bridge Builder, Chicago; "Economic Efficiency of Tile Drains and Open Ditches." D. J. Stanford, County Surveyor, Chatsworth.

Steps are being taken to secure railroad rates of 1½ fare. Notice of the final arrangements will be sent to

Steps are being taken to secure railroad rates of 11/3 re. Notice of the final arrangements will be sent to tembers. Those desiring to join the society should write

to the secretary for certificates to be signed by the ticket agent at the starting point.

The hotels will give reduced rates. The Revere House

will be made headquarters, and programmes for the meeting can be obtained there.

The Executive Secretary is A. N. Talbot of Champaign,

ST. PAUL CIVIL ENGINEERS.

ST. PAUL CIVIL ENGINEERS.

ST. PAUL, January 10.—Last night the annual meeting of the St. Paul Civil Engineers' Society was held at the Hotel Ryan. A paper was read by M. A. Munster upon the formula for calculation of plate-girders. A. Johnson, United States Assistant Engineer, read a paper on the preservation of the Falls of St. Anthony, at Minneapolis, citing the work of 1883 done under the direction of Major C. J. Allen. The following officers were elected for the ensuing year: President, C. F. Lowett; Vice-President J. H. Morrison; Treasurer, J. C. L. Annan; Secretary, George L. Wilson; Librarian, A. Munster. L. Wilson; Librarian, A. Munster.

BUILDERS' NATIONAL CONVENTION.

THE annual convention of the Builders' Exchanges of the various builders of the United States is to meet this year at Cincinnati, February 7. The meetings will be held at College Hall and the headquarters at the Gibson House. Exchanges have been organized at Charleston, S. C., New Orleans, and Baltimore. The report on uniform form of contracts is expected to be an important featform form of contracts is expected to be an important feature of the discussions.

"THE IRON AGE."

WE congratulate the *Iron Age* on its change of form and new make-up. We can hardly doubt that every one of its readers and advertisers will appreciate how great the improvement its present form is to the old one, which always seemed to us unwieldy and inconvenient. Our contemporary has our best wishes for its continued prosperity. perity.

SAVANNAH SEWERAGE PLANS.

WE were in error in the reference in our editorial last week to the proposed plan for a system of sewers for Savannah in stating that several plans were made. Colonel Waring was the only engineer employed to submit a plan,

INTERIOR DECORATIONS

INTERIOR DECORATIONS.

WE have received a work under the above title, by Arnold W. Brunner and Thomas Tryon, architects, of this city. A portion of the matter originally appeared in Building. The hall, staircase, library, parlor, dining-room, study, and bedrooms are treated; besides fifty vignettes, there are fifteen tull page plates. The authors state that their "aim is simply to touch upon the points that arise in connection with the subject, and to present suggestions rather than definite instructions on decorative questions." It is published by William T. Comstock, 23 Warren Street, New York, at \$3.

PERSONAL.

GEORGE E. EVANS has succeeded George Bowers as City Engineer of Lowell, Mass.

C. HOWARD WALKER and Herbert R. Best, architects, of Boston, became associated as partners January 1.

J. McNulty, E. M., has returned to New York after a prolonged absence in the Southern mineral regions, in whose development he is engaged.

M. J. BECKER, Chief Engineer Pennsylvania Company's South-Western System, has removed his office from Columbus, O, to Pittsburg, Pa.

SAMUEL R. FILLEY, a successful merchant, and the promoter of the Suburban Rapid Transit Railroad of New York, and its first president, died suddenly on January 8.

MR. FRANK WALLER and Mr. William F. Widmayer have combined their offices for the purpose of practicing as architects and engineers at 31 and 33 Broad Street, New York City.

FREDERICK MERCER, Superintendent of Lehigh Valley Coal Co., died at Wilkesbarre, Pa., on January 11. Mr. Mercer at one time was Chief of the Engineering and Construction Department of the Lehigh Valley Railroad, and as such built its lines from Penn Haven to Wilkesbarre.

COLONEL A. P. BLUNT, U. S. A., lately in charge of the Military Depot at Fort Leavenworth, Kansas, has been assigned to duty as Depot Quartermaster, Fort Leavenworth, Kansas. Captain J. W. Pope, U. S. A., has been appointed to the position made vacant by Colonel Blunt's removal Colonel Blunt's removal.

Digitized by GOGIE

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

MESSRS. MAHAN, PORTER & Co., manufacturers of sewer-pipe, fire-brick, stove-pipe, chimney-tops, flue-linings, lawn-vases, etc., at New Cumberland, Hancock County. W.Va., have just issued an illustrated descriptive cata logue price-list of their wares.

SAMUEL H. FRENCH & Co., paint manufac, turers, and importers and dealers in painters and builders' supplies, of York Avenue, Fourth and Callowhill Streets, Philadelphia, Pa., have just issued their catalogue and price list for 1888, with an index. The catalogue fills more than 200 pages and fully illustrates and describes a variety of architectural plaster work, slate mantels, grates, and open fire-places, plain and ornamental glass, etc., etc.

THE Chalmers-Spence Co., of 419-425 East Eighth Street, New York, have just issued a revised illustrated catalogue of their asbestos material, fire-felt, etc.

THE Brown Hoisting and Conveying Machine Company, of Cleveland, O., send us their illustrated and descriptive pamphlet.

THE catalogue of the Newton Machine Tool Works, of 24 Wood Street, Charles C. Newton, engineer and proprietor, is among the mercantile catalogues just receiced.

THE Standard Car-Heating and Ventilating Co., of Pittsburg have sent us their pamphlet explaining and describing the Westinghouse heater.



For works for which proposals are requested see also the "Proposal Column," pages i-v-vii-viii-112-ix.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and rel able news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

NEW YORK.—The Croton Aqueduct Commission will shortly advertise for proposals for about twenty-five thousand tons(2,000 pounds) of 48-inch cast-iron water-pipe 12-foot lengths, and one thousand tons of special castings; also, for laying same from One Hundred and Thirty-fifth Street to Central Park Reservoir in eight lines; construction of gate-house, also.

PHILADELPHIA, PA.—A movement, looking to the appointment of a commission of experts to examine into the feasibility of improving the sewerage system of the city of Philadelphia, has been inaugurated by the introduction of an ordinance into city councils and its reference to a committee which met some day since to consider the subject. No action was taken at the meeting, but an adjournment was had in order to allow the committee to secure more information and procure a report on the subject, prepared some years since by Rudolph Hering.

MILWAUKEE, WIS.—It is probable that several thousand dollars will be expended on sewer work here this year. The Board of Public Works is already considering numerous improvements in the south side of the city.

ROCKFORD, ILL.—Daniel W. Mead, City Engineer, writes us as follows concerning the projected sewerage system: "I am now finishing the plans for a system of sewers for th s city. The work will be completed by spring. The city has good natural drainage, and but little storm-water will therefore be taken into the sewers. The sewers will be mo tly pipe-sewers."

SIDNEY, O.—Our correspondent writes:

'The vote on appropriating \$10,000 for the improvement of our water-works carried by 210 majority. J. N. Anderson, Secretary of Water-Works Board, can furnish particulars of what will be done and when work will be let.'

SANFORD, FLA.—Our correspondent writes: "We are making the following improvements to our water-works: New pump and boiler increased in size, boiler from 20 horse-power to 65 horse power, pump from 4-inch to 10-inch, Worthington; old pump, etc., will also be held as reserve; large brick reservoir, 50 feet in diameter, 16 feet deep; new mains increased in size from 3, 4, and 6 to 4, 6, and 10 inch.

DENVER, Col.—City Engineer H. C. Lowrie writes: "After seven years' experience in our system of separate sewers we are about to double our quantity, and the plans and specifications for this work, the same in general features as those of the old, were adopted, not only without criticism, but without investigation or a single inquiry by any one."

BROCKTON, MASS.—Concerning a published report that water-works were to be built here our correspondent writes as follows: "We established a system of water-works several years since and they are in successful operation."

Boston, Mass.—The Council order that the Mayor be requested to petition the Legislature for the passage of an act to authorize the city of Boston to construct subways for sewers, water-mains, etc., and to lease the privilege of using the same to the various telegraph, telephone, gas, and electric-lighting companies, has been referred to a special committee, consisting of Aldermen Gove, Wilson, and Short.

Brantford, Canada.—The water-works question is again being agitated here and conclusive developments may soon be expected. The City Council will probably dispose of the matter, which has been in an unsettled state for over a year, at its next session.

MILWAUKEE, WIS.—The shaft on Dane Place, through which the earth to be taken from the big flushing tunnel bore will be removed, has reached the required depth, and the work of putting in the solid brick bottom has been completed. As soon as possible the necessary hoisting machinery will be placed in position and the work of drifting will be begun. A coffer-dam to keep back the waters of the lake has been built, and the pumps put in operation. The shaft or well at the foot of the bluff has been sunk about ten feet.

MARINE CITY, MICH., will vote on February 6 on the proposition to issue \$8,000 bonds for extending their water-works system.

MODESTO, CAL.—The sum of \$800,000 in bonds will be issued for a canal for the Modesto irrigation district.

PHŒNIX, ARIZ.—The McPherson Canal Co. has been incorporated with a capital stock of \$2,000,000. The canal will be 40 miles long and will irrigate 100,000 acres. Considerable of the work remains unlet.

Los Angeles, Cal.—The Hosperia Water Company of this city has been incorporated; capital stock, \$2,000,000. ('. A. Barnes, and others, incorporators.

- STRONG CITY, KAN.—A water-works company has been organized here. Address W. P. Martin.

MACON, GA.—Our correspondent writes from here, stating that the election which was to have been held on the 7th inst., did not take place, as the call for such an an election was repealed by the Common Council, owing to an apparent legal objection. No further steps have been taken.

Jamaica, N. Y.—The Town Board of this place has received from the newly completed Woodhaven Water Works Company an application for permission to supply the town with water. The capital stock is represented to be \$50,000, and the incorporators are Florian Grosjean, John C. Mulligan, and others. The Town Board and the Commissioners of Highways will meet in joint session on the 20th inst. to determine the matter.

Hugo, Kan.—It is reported that the waterworks system here is to be extended.

CAMBRIDGE, MD.—In reference to waterworks matters here our correspondent writes as follows: "The Board of Trade is in correspondence with parties and expect proposals. Communications on the subject may be addressed to A. H. Bayley, Mayor, or to the Board of Trade, Cambridge. No definite plan adopted as yet."

KANE, PA. — Concerning a report that water-works were to be constructed here, our correspondent writes: "The water-works here were completed this fall under the name of the Spring Water Co., of Kane."

WATKINS, N.Y.—Our correspondent writes as follows about water works matters: "Our citizens have commenced agitating the subject of water-works, etc., and a meeting to discuss the question will soon take place. After it has been held and some definite action taken, I will keep you advised from time to time."

Monson, Mass.—Our correspondent writes from here as follows: "A petition is now pending before the Legislature for a charter for the incorporation of a water company."

LEBANON, PA. — A. Harvey Tyson, of Reading, who has been employed to investigate the sources of water-supply, has made his report to Councils, recommending the tapping of the Swatara Creek at Jonestown, and the building of a pumping-station and standpipe and attachments, at a cost of \$200,000. The special Committee on Water recommended the adoption of this plan and submitted a proposition from Messrs. Arthur and Horace Brock, who offered to build the entire works and lease them to the city at a rental of five per cent. on the cost. It is expected that conclusive steps will shortly follow.

EL PASO, TEX.—A movement is on foot in Western Texas and Southern New Mexico to secure Federal aid, if possible, in building an irrigating canal, from 200 to 230 miles long, for the purpose of reclaiming vast tracts of land that are now arid wastes. It is proposed to start the canal at a point on the Rio Grande above the Jarnado Del Murte, in New Mexico, and carry it along the high lands of the Rio Grande Valley as far below El Paso as it is found practicable.

NEEDHAM, MASS.— Our correspondent writes from here as follows: "At a town meeting, held December 29, 1887, it was voted that a committee of five be appointed or elected for the purpose of peritioning the next Legislature for a charter to enable the town of Needham to put in such a system of waterworks as the town may hereafter vote for."

Weffing Water, Neb.—Our correspondent writes: "An election held January 3 to vote on the proposition for issuing \$15,000 bonds for the construction of a system of water-works in Weeping Water resulted in favor of establishing the works. The bonds have not yet been issued, nor has the contract been let."

NIAGARA FALLS, N. Y.—Concerning a published report that this place was to erect water-works, our correspondent writes: "The village of Niagara Falls have had the Holly system of water-works in for the past eight years."

PORTSMOUTA, VA.—It is reported that the Portsmouth and Suffolk Water Co. is negotiating for a site on which to erect a reservoir.

NESS CITY, KAN.—A report is circulated that \$25,000 will be expended in establishing water-works here.

MALDEN, MASS.—It is probable that the water-works system here will be improved soon.

HIGHLAND, COL.—Several thousand dollars' worth of water-works improvements will be commenced here at once.

SONOMA, CAL.—A water-works company has been established here. George H. Maxwell can give information.

JEFFERSON CITY, Mo.—F. B. Perkins, of Springfield, Mo., has been granted a franchise to erect, maintain, and operate a system of water-works in this city. Work is to begin at once.

CANON CITY, Col.—It is reported that a separate water-supply is to be established for the prison buildings.

LONDON, CANADA. — Our correspondent writes: "A by-law to authorize the issue of debentures to the extent of \$750,000 for the increase of the water-supply and other purposes in connection with the water-works was submitted to the people and defeated January 2, 1888. The supply at present is about 2,000,000 gallons daily and the proposed increase was about 1,500,000 gallons per day, all of which is spring water of the finest quality. The result of the vote is that the extension will lay over for another year."

BRIDGES.

BROCKPORT, N. Y.—In answer to an inquiry about a projected bridge here we are informed by our correspondent as follows: "Bridge being built by the State. Contract let by the Superintendent of Public Works. He will give full information. The village has nothing to do with it."

DAYTON, O.—The Commissioners of Mongomery County are considering the question of erecting a \$20,000 bridge over the Mad River, near its mouth.

LAREDO, TEX.—The Intermediate Bridge and Tramway Co. will build a bridge over the Rio Grande at this place.

HARRISBURG, PA.—The sum of \$55,000 will be expended in bridges here. Address Charles E. Pugh, General Manager, Pennsylvania R. R. Co., 233 South Fourth Street, Philadelphia, Pa.

MILLBURY, MASS.—Address Charles Howard, Superintendent of the Providence and Worcester R. R., for details of bridge to be erected here. Office at Providence, R. I.

ONEONTA, N. Y.—Concerning a report that a bridge was to be erected over the Susquehanna at this place, our correspondent writes: "There has not been as yet any steps taken for the construction of a bridge over the Susquehanna River, nor is the question yet agitated officially."

JACKSON, N. H.—A large bridge will probably be erected here.

WESTFIELD, MASS.—The town of Chicoper will erect an 80-foot bridge.

NAVESINK, N. J.—A new bridge will probably be placed over the Shrewsbury River at this place.

LONG LAKE, N. Y.—It is reported that a bridge is to be erected over the lake.

FORT PLAIN, N. Y.—Address the County Commissioners for details of projected bridge for this place.

AYLOMER, CAN.—Several new bridges will be erected here.

GAS AND ELECTRIC-LIGHTING.

NEW BRUNSWICK, N. J.—The Common Council has declined to grant a franchise to the gas company to erect poles and electric light plant in the streets of this city. Some two years ago, when the electric-light company was started, and before the price of gas was reduced by the competition, the gas company secured a contract with this city for three years. This contract expires next year, and the gas company wish to secure another franchise for electric-lighting in addition.

HELENA, ARK —An electric-light plant, to cost \$25,000, is to be built here.

STRONG CITY, KAN.—An electric light and gas company has been established here. W. P. Martin is at its head.

EAGLEVILLE, ILL.—The citizens of this place have organized to drill for gas.

BAXTER SPRINGS, KAN.—Capitalists from St. Louis and Kansas City have decided to bore wells and supply this place with natural gas.

NEWCOMERSTOWN, O.—This place is to be supplied with natural gas by the South-Western Natural Gas Co., who will pipe the streets as soon as the weather permits.

FREDONIA, N. Y.—An electric-light plant is projected for this place.



Oskaloosa, Iowa.—An electric-light plant will be erected here.

TOLEDO, O.-An electric-light plant is to be established here.

PETERSBURG, VA.—A fuel power lighting company has been formed here to construct and operate water-gas works in the city of Petersburg for lighting and heating purposes, and supplying gas as fuel for manufacturing, cooking, and mechanical purposes.

SLATINGTON, PA.—The Citizens' Electric Light and Power Company has concluded arrangements by which it will light this place by the latter part of January. The Richter Electric Light Co., of Camden, N. J., will put up the plant and put in the lights. The entire cost will be about \$10,000.

REIDSVILLE, N. C.—It is reported that this place will be lighted by electricity.

STREET WORK AND PAVING.

MILWAUKEE, WIS.—Several streets in different portions of the city are to be paved with cedar and granite blocks.

RAILROADS, CANALS, ETC.

MAINSTEE, MICH.—The Chicago, St. Louis and Paducah Railroad Co. has just completed 15 miles of road, has 25 miles more under contract, partly graded, and about 14 miles more yet to be located.

HAMMONTON, N. I.-A new railroad, 18 miles long, is about to be constructed from this place to Tuckerton, Burlington County, by Joseph D. Wharton, of Camden.

MILWAUKEE, Wis.—At a recent Council meeting the Hinsey South and East side cable ordinances were read a third time and ordered engrossed without debate.

BIDS OPENED.

MILWAUKEE, WIS.—Synopsis of bids for furnishing 100 double-nozzled fire-hydrants opened January 6 by the Board of Public Works:

Galvin Brass and Iron-Works, Chicago, Ill. single-valve, Matthews' pattern, \$38. R. D. Wood & Co., Philade!phia, Pa., iron valve and waste, \$38; brass valve and waste,

\$39.50.
The contract was awarded to R. D. Wood

HOPEDALE, ILL.—Synopsis of bids for constructing water-works, opened January 2 by J. P. Waldon, Town Clerk: George G. McManis & Sons, Princeton, Ill., \$2,195; Challenge Wind and Feed Mill Co., Batavia, Ill. \$2,200; C. M. Hoghton, Delavan, Ill., \$2,140. The contract was awarded to the lowest midder.

MILWAUKEE, WIS.—Synopsis of bids for furnishing 1,000 tons of cast-iron water-pipe for the mains of the city, opened January 6, by the Board of Public Works:

ridder.

N			Sizes	Sizes of Iron Pipe.	Pipe.		
NAMES OF CICERRS	20-inch.	16-inch.	12-inch.	8-ınch.	20-inch. 16-inch. 12-inch. 8-inch. 6-inche 4-inch. 3-inch.	4-ınch.	3-inch.
Dennis Long & Co., Louisville, Ky	00.0¢	\$70.00		\$31.00 \$31.50	\$32.00	\$32.50	\$33.00
Foundry Co			29.9 5	29.95	29.95	30.70	30.70
Cleveland, Ohio	28.70	28.70	28.70	28.70	28.70	28.90	28.90
Newport, Ky	28.20	28.20	39.3 0	30.20	30.20	31.20	32.20
& Howard Co	28.70	28.70	28.70	28.70	28.70	29.95	31.45

The contract for furnishing the 3, 4, 6, 8, and 12 inch pipes was awarded to the Shickle, Harrison & Howard Co. The contract for 16 and 20 inch pipes was awarded to the Addyston Steel Co.

BALTIMORE, MD. - Synopsis of bids for furnishing the following cast-iron pipe, etc., opened January o by Robert K. Martin, Chief Engineer Water Department:

Mellert Foundry & Machine Co., Limited, Reading, Fa.	Gloucester Iron-Works., Gloucester City, N. J	R. D. Wood & Co., Philadelphia, Pa	The McNeal Pipe & Foundry Cc., Burlington, N. J.	HIDDERS.
:	: 2717	101/2	q.6c.	11/2-inch. Per ft.
:	18	15%	q.6c. 16.28c.	2-inch. Per ft.
:	23	19.4		3-inch. Per ft.
32	33	8	30.36с.	4-iach. Per ft.
45	45.9	43	44.254C	6-inch. Perft.
63	63.19	59	20.09c. 30.36c. 44.254c. 60.941c. 80.63c. \$1.15	8-inch. Perft.
8	83.45	78	80.63c.	10-inch. Per ft.
1.20	1.20	1.17	\$1.1 5	12-inch. Per ft.
31.36	30.59	30.73	\$29.45	20-inch. Per ton of 2,240 lbs.

BOSTON, MASS .- The Court House Com-BOSTON, MASS.—The Court House Commissioners have awarded to the Cape City Granite Company, of Gloucester, and the Hurricane Island Granite Company, of Rockland, the contract for furnishing the granite required to complete the main building of the court house. The contract price for the whole is \$305,500, each company to furnish equal quantities of stone.

BROOKLYN, N. Y.—The following proposals were opened January 5, for furnishing and placing heating apparatus in the Third District Police and Civil Justice's Court-House, to wit: Thomas C. Delaney, work complete, \$1,445; Jacob Jamer, work complete, \$1,355; Phillips, Doup & Co., work complete, \$1,295.

NEW YORK CITY.—The Park Department has awarded to William J. Clark, at \$26,830, the contract for paving the Southern Boulevard from Third to Willis Avenue, and to William F. Murray, for \$28,790, the contract for regulating and grading certain sections of St. Ann's Avenue.

BROOKLYN, N. Y.—The following proposals were opened January 5, for furnishing and placing heating apparatus in the Sixteenth and placing heating-apparatus in the Sixteenth Precinct Station House, to wit: Thomas C. Delaney, work complete, \$1,525; Phillips, Doup & Co., work complete, \$1,435; Jacob Jamer, work complete, \$1,314.

BROOKLYN, N. Y.—President pro tem. Beasley, of the Board of Supervisors, has signed the contract with Edward Freel for an expenditure of \$356,000 on the County Farm at St. Johnland, in laying out roads, sewers, etc., and preparing for a water-supply.

etc., and preparing for a water-supply.

PHILADELPHIA, PA.—Bids were opened January 10 at the Gas Bureau for excavating and walling a new gas tank and erecting a gas holder at the 15th Ward works. The bidders were, for excavating and walling tank, E. D. Smith, \$17,700; James Sullivan, \$38,500; for the holder, Morris, Tasker & Co., \$11,595.65; Camden Iron Works, \$13,740. The lowest bidder in each case received the contract.

MINNEAPOLIS, MINN.—The Police Comis-MINNEAPOLIS, MINN.—The Police Comission have awarded contract for asphalt paving at the new Central fire station to the Minneapolis Asphalt Paving Co. at 12½ cents per square yard.

Bids have been opened by the Water-Works Committee for furnishing \$3,051 feet of cast-

iron pipe, ranging from 6 to 24 inches. The committee recommended contract be awarded to Dennis Long & Co., of Louisville, Ky. The bids were as follows:

Addyston Pipe and Steel Co., Cincinnati, \$31.40 per ton; Mellert Foundry and Machine Co, Reading, Pa., \$35: Lake Shore Foundry, Cleveland, \$30.14; Shickle. Harrison & Howard, St. Louis, \$31.10; Dennis Long & Co., \$29.97.

GOVERNMENT WORK.

CANANDAIGUA, N. Y.—Synopsis of bids for fire-proof chest for post-office opened January 7 by the Supervising Architect of the Treasury Department:

Macneale & Urban, Cincinnati, O., \$375;
H. H. Miller, Baltimore, Md., \$385; Martin Safe Co., New York and London, \$522.

MEMPHIS, TENN.—Synopsis of bids for furnishing the following named articles for improving Vicksburg Harbor, opened December 29 by William T. Rossell, Captain of En-

Bidden	r,000 piles. Per foot.	350 stringers. Willow. Each.	340 braces—willow Each.	2,000 cords brush Per cord.	2,000 cub·c yards rip-rap. Per cu. yd	350 stringers. Cypress. Each.	340 braces. Cypress. Each.	Remarks.
M. V. McBride, Greenville, Miss	6½c.	50 80 80 80	\$0.40 .37½	5.45 1.30		1.00	\$ 0.50	\$1.05 \$0.50 Delivered at Vicksburg.
McBride & Evins, Greenville, Miss	61/2c.	.98	S	1.45	:	8	. 50	.50 Delivered at Vicksburg.
Van Buren, Mo	9½c.	1. 30	8	1.75	:	1.30	8	
Memphis, Tenn	121/5c.	:	1.50	8	1.30	* . 8	1.50	
Clarks France								

Toledo, O.—Synopsis of bids for placing in position, in complete working order, in the Custom-House building, certain electric lights and gas fixtures, opened January 9, by C. S. Fairchild, Secretary, Treasury Department: Schultz Gas Fixture and Art Metal Co., Baltmore, Md., \$2,162.75.

R. Hollings & Co., Boston, Mass., \$3,036.
The Horn, Brannen and Forsyth Mfg. Co., Philadelphia, Pa., \$2,191.45.

MISCELLANEOUS.

THE Santa Barbara Lumber Co. are building a lumber wharf several acres in extent at a cost of \$150,000, so arranged as to unload from cars or ships; expect also to import coal, etc. They having one of the best harbors on the Pacific coast.

MANCHESTER, N. H.—The design of Fred W. Stickney, of Lowell, Mass., for the Elliott Hospital, to be erected here, has been accepted.

PROPOSALS. (Continued from page viii.)

JAIL.—Proposals are wanted at Georgetown, Tex., for erecting a limestone jail. Estimated cost. \$30,000 No date specified. Address the County Commissioners

JAIL.—Proposals are wanted at Leesburg, Va., until February 4, for erecting a jail. Bids for iron and steel work are to be separate. Address Edgar Littleton

BUILDING PIER.—Proposals are wanted at New York City until January 27, for removing the existing pier at the foot of West Thirty-eighth Street, and for preparing for and building a new wooden pier and approach at the foot of said street, and for repairing the existing crib-bulkhead thereat. Address the Department of Docks, Pier 1. North River.

WATER-WORKS.—Proposals are wanted at Joliet, Ill., until February 1, for the construction of a twenty-mile system of water-works. Address Mayor John D. Paige.

PROPOSALS.

FLAGGING.—Proposals are wanted at Brooklyn, N. Y., until January 18, for flagging in certain streets. Address George Ricard Conner, Commissioner of the Department of City Works.

HEATING AND VENTILATING APPARATUS.—Proposals are wanted at Cleveland, U., until January 23, for the heating and ventilating of a hospital building. Address Messrs. Lehman & Schmitt, Architects, Room 31, Benedict Block, Cleveland, O.

ELECTRIC - RAILROAD FURNISHINGS.— Proposals are wanted at Little Rock, Ark., until Jan-uary 21, for furnishing train 1ail, frogs, and switches, cuives, crossings, joint-plates, kneed, spikes, etc., for a single-track, 48½-inch gauge. Address Fired J. H. Rickon, Engineer, City Electric Railway, Little Rock,

HIGHWAY SUPPLIFS.—Proposals are wanted at Reading, Pa., until January 18, for furnishing certain supplies for road work. Address George H. Felix. Secretary, Highway Department.

TELESCOPE-HOLDERS.—Proposals are wanted at Washington, D. C., until January 2t, for fifty, more or less, telescope-holders, according to specification. Address R. W. Greely, Chief Signal Officer, War Department, Washington, D. C.

STEAM-HEATING. — Proposals are wanted at Washington, D. C., until February 12, for supplying and putting in place, complete, in the Court-House and Post-office at New Albany, Ind., a low-pressure return-circulation steam-heating and vectifating apparatus. Address Will A Freret, Supervising Architect of the Treasury Department.

(Continued on page ix.)

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—6 s. brown stone; br. brick; br st. brick store; bs dwell, brown-stone dwelling; aperit house, apa* uent-house ten, tenement; e, each s. owner; a, architect; b, builder; fr. frame.

NEW YORK.

30 Market st, rear, 1 br shop; cost, \$6,000; o, H Weinstein; a, Rentz & Lange.

225 Clinton, s w cor Rutgers pl, 1 br shop; cost, \$10,000; o, Samuel Langer; a, Rentz & Lange.

Boulevard, n w cor 88th, I s and br ten and store; cost, \$25,000; o, F Mulligan and J E Post; a, J S Post.

Boulevard, w s, 27.6 n 88th, 2 s and br flats; cost, each, \$20,000; o and a, same as above.

Boulevard, w s, 83.8 n 88th, I s and br ten: cost, \$15,000; o and a, same as above.

6th av, s e cor 122d, I school, and 122d, s s. 32 e 6th av, I s church; cost of superstructure—church, \$95,000, and school, \$50.000; o. Holy Trinity Church, Rev J Newton Stanger, rector; W A Potter.

W s 7th av, 40 n 122d, br dwell and stores; cost, \$50,000; o and a, G Robinson, Jr.

Se cor 75th and 10th av, brick ten; cost. \$34,000; o, Chas A Fuller; a, E L Angell.

S s 114th, 2co w 1st av; 2 br ten; cost, all, \$28,000; o and a, Wm Fernchild.

N s 70th, 223 e Ave A, brick factory; cost. \$18,000; o, Jas Marren; a, Edward Wenz.

ALTERATIONS-NEW YORK.

13 E 42d. 1-story s extn; cost, \$16,000; o, Mrs Amos Cotting; a, E D Lindsey.

1981 Broadway, br office bldg; cost, \$10.000; o, Dennison Mfg Co; a, not given.

425 E 24th, br factory; cost, \$10,000; o. East River Electric Light Co; a, not given.

N w cor 78th and 9th av, brick flat; cost. \$150,000; o, Milliken & Smith; a, D & J Jar.

517-519 Washington, br stable and shop; cost, \$7,000; o, Peter H Ohmeis; a, William Graul.

421-427 W 15th, br factory; cost, \$50,000; o, Bradish Johnson; a, J M Dunn.

BROOKLYN.

Fulton, n s, 48.3 w Throop av, 10 b s stores and dwells; cost, \$90,000; o and m, Thomas Donahue: a, J H Maguire.

81 Neville, fr ten; cost, \$5,400; o. Robert Shepard; a, A Van Diln.

212 Stagg, fr ten; cost, \$5,000; o, John (; Beil; a, Th Engelhardt.

S s Vernon av, 175 e Tompkins av, 5 br dwells; cost, \$25,000 all; o, James W Stewart; a, I D Reynolds.

Es Hamburg av, 25 n Troutmann, 3 fr dwells and stores; cost, \$15,000 all; o, Jen-kins & Hahn; a, as above.

Digitized by GOGIC

BUILDING INTELLIGENCE.

OMAHA. NEB.—For details of a \$500,000 hotel, address G M Hitchcock

WILLET'S POINT, N. Y .- It is reported that Irving Hale can give details of four-teen sets of officers' quarters and public buildings to be erected at this post.

TORONTO, CAN. — Address Ex-Mayor Howland for details of projected drill-hall.

BLOOMDALE, O.—An armory for the Second Regiment, O N G, will be erected

TITUSVILLE, PA.—For details of new school building to be erected address H S

TORONTO, CAN .- The Hon G W Rosser can give information of a college to be built

MILWAUKEE, WIS .- The Wisconsin Consistory will erect a stone building in this city to cost \$100,000. The plans have not yet been made.

EXCELSIOR, ILL.—The Chicago, Milwaukee & St. Paul RR. Co. will erect a large hotel here on Lake Minnetonka.

KANSAS CITY, MO.—5th, cor Delaware st, repair and altns National Bank of Kansas City; cost. \$25,000; o, National Bank of Kansas City; a, F. S. Steward.

Thirty-three buildings, none costing \$7,000 or over.

BOSTON, MASS.—130 Tremont, br st and offices; cost, \$50,000, o, Thomas estate; a, John A. Fox.

CHICAGO, ILL.—915-23 W Jackson, br dwell;cost, \$25,000; o, George Raymond; a, FW Hinsdale; b, Gilbert.

199-201 N Halsted, br factory; cost, \$12,-000; o, Dawson Bros; a, B N Branch.

201-42-46 Hammond, br flats: cost.\$10. 00, o, Jacob Becker: a, Adam Booz; b, J Becker.

T-5 W Lake, br warehouse; cost, \$60,-000; o and b, Louis J Doegling; a, Thomas & Rodgers.

CHATTANOOGA, TENN.-The Manufacturing Company, for manufacture of building hardware, will soon be put in operation here. Plans for building and the plant are ready. The company is capitalized at \$250,000

MILWAUKEE, WIS.—North Water st, 5-story br bldg; cost, \$15,000; o, Hermann Zoehrlant Leather Co

6 bldgs less than \$7,000

BUILDING INTELLIGENCE.

GOSHEN, IND.—A \$30,000 City Hall is to be erected here.

DENVER, COL.—Arapahoe st, 4-story and stone block; cost, \$60,000; o, W Lewis; a F E Edbrooke

Alta st, 4-story br school; cost, \$125,-000; o, Wollfe Hall; a, Jno Roberts

Glenarm st, Masonic Temple; cost,

Holliday st, 3-story br store bldg; cost, \$20,000; o, G Liebhardt; a, F C Eberly.

CHATTANOOGA, TENN.—Market and 7th sts, 7-story stone and office bldg; cost, \$150,000; o, Chattanooga Loan and Trust Co.; a, Thos Sully & Co

7th and Chestnut st, 4-story stone bldg; cost, \$25,000; o, John P Richardson and Ed Watkins; a, same as above

PHILADELPHIA.—Duval, bel Johnston, 2 dwells; b, Robt Christy.

734 Market, 1 5-story b s bldg; b, Thos Little & Son.

3d, n of Huntington, 1 2-story factory; b, John M Kennedy.

WILLIAMSPORT, PA .- Nothing over \$7,-000 in value to report this week

WORCESTER, MASS.—Nothing over \$7,-000 in value to report this week

TORONTO, CAN.—It is probable that the Canadian Pacific Railway will, during the coming year, erect numerous depots, freight houses, etc., in this city. According to published reports a large amount will be expended, and plans for portions of the undertaking are already being prepared

WEST SHEFFIELD, CONN.—Address H S Sheffield for details of new library building

OUNT LEBANON, PA.—Address the Rev W M Reese for details of Baptist Col-lege to be erected here MOUNT

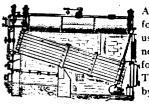
ROCHESTER, MINN.—An opera house is to be built here from plans made by tect H. G. Carter, of St. Paul, Minn

POUGHKEEPSIE, N. Y.—The Dutchess County Supervisors will erect an armory

JAMESTOWN, N. Y.—A library building to cost \$75.000 is to be erected here. Address Mrs A T Pendergast. We are informed that we erred in printing this item Jamestown Pa last week. It should have been Jamestown, N Y

MEMPHIS, TENN.—A school building to cost \$40,000 is to be erected in this city

"STEAM



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E NGINEER OF EXPERIENCE WILL ACCEPT engagement with engineer, contractor, manufacturer or an agency. Extensive experience in estimating, designing and superintending. Well acquance and best references. Address L. F. R., care this office.

A YOUNG ENGINEER seeks re-engagement & assistant draughtsman, preferably in Boston First-ciass testimonals and references. Address Goddin, 200 West Springfield Street, Boston, Mass.

A CIVIL ENGINEER of experience, who is a good mechanical and topographical draughtsman, desires employment. Address CIVIL, care this office.

ENGAGEMENT WANTED by advertiser (Enlish), who was established in Frankfort, Germas, for eleven years; thoroughly efficient in the management of materials and men; good draughtsmen act correspondent; knows markets and manufacturers in Europe of specialties; speaks German, and is thoroughly posted in sanitary science; age, forty-sere. Address W. G. King, Stratherne Post-Office, Naritoba, Canada.

A YOUNG JOURNALIST, formerly an architect, and for some time associate editor of a well-known technical paper is desirous of obtaining arrengagement in connection with a journal. Address, care this office.

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WANTED.—A situation as salesman in plumbing supply and specialty business. Four year ererience. Address C., No. 47 Pitt Street, New York

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THE FOLLOWING PUBLICATION IS NOW READY AND FOR SALE.

TITLE PAGE.

A COLLECTION OF DIAGRAMS

Representing the General Plan of

TWENTY-SIX DIFFERENT WATER-WORKS,

Contributed by Members of the

New England Water-Works Association,

And Compiled by a Committee.

1887.

NEW YORK:

PUBLISHED BY THE ENGINEERING AND BUILDING RECORD, 82 & 84 FULTON STREET.

INTRODUCTION.

OFFICE OF SECRETARY.

NEW BEDFORD, MASS., November 1, 1887.

THIS collection of diagrams is the result of the persistent efforts of Messrs. William B. Sherman, of Providence, R. I., and Walter H. Richards, of New London, Conn., who, as a Committee on Exchange of Sketches, have secured these drawings from members of the Association. The following extract from a report presented by these gentlemen at the Manchester, N. H., meeting in June, 1887, will explain in part the origin of the collection:

"In answer to circular letters sent out to members, there

"In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three were received rough sketches of general plans of twenty-three water-works represented in the Association. Having this data on hand, though crude in many particulars, it was decided to put the same into available shape for the benefit of the members. This has been accomplished by the Committee without cost to the Association. From these rough sketches—revised, reduced to uniform size of 10 by 15 inches—a set of tracings has been made, and a sample folio of blue prints prepared. This folio and set of tracings are herewith presented as forming the main part of this report."

Since the Manchester meeting three more subjects have been received and subscribtions for sets of reproductions from the tracings have been called for. The ready response to the call is evidence of the value of the Committee's work, and arrangements were made with The Engineering And Building Record for publication in this present form.

R. C. P. COGGESHALL,

Secretary,

Secretary, New Figland Water-Works Association.

Address, Book DEPARTMENT.

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THE ENGINEERING AND BUILDING RECORD, 82 & 84 Fulton Street. New York.

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VOLUME 17. NUMBER 8.

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WHY THE LITTLE ROCK RESERVOIR BURST.

Our readers will remember an account of this accident which appeared in our issue of November 12, 1887. It seemed pretty clear at that time that the wall fell over because it had not sufficient breadth of base, but it now appears that this was altogether a mistake.

The Arkansas Press has discovered the true cause of the accident and publishes it to the world as follows. After stating that "a number of societies composed of scientific men have discussed it, but none of their arguments were correct," the Press says:

"The cause of the accident was solely due to the geological formation of the ground, which is at variance with nearly every law of nature. The primitive whinstone, or trapp-rock, was found lying upon a loose bed of rotton sandstone, enclosing a strata of fire-clay or soapstone."

This is, indeed, a deplorable "state of facts,' a marked and melancholy instance of what has well been called "the total depravity of inanimate things." As Mr. Squeers remarked. "Natur' is things." As Mr. Squeers remarked, "Natur' is a rum un," and in this case she evidently "put up a job" on the too confiding Colonel Zeb (the contractor) by carefully covering an eligible reservoir site with what would appear to his unsophisticated eyes, and those of the Arkansas Press, to be a "primitive" formation. She then greased the under side of this trap rock (most appropriate name) with her slipperiest materials and calmly awaited developments.

Of course, any intelligent engineer would know that trap-rock, far from being "primitive," is a very late geological formation of volcanic origin and most uncertain relations, and would have made some preliminary borings to see what was below; but Nature knew her man and bided her time, and she was not disappointed. Zeb came, wall slid, she conquered.

Now, to quote again from our esteemed contemporary (the italics are ours):

"In building the middle wall there was a footing for about 100 feet dug below the lower reservoir. The footing-course in this 100 feet could not have slipped, as the greatest thickness of the wall at this point was nearly fourteen feet."

Here we have at last the "immovable body" which philosophers have so long discussed and never discovered. It is a wall "nearly fourteen feet thick." If De Lesseps would only put such a wall alongside of his Panama Canal he would have no more trouble with that mountain which is said to be sliding into it.

The Press goes on to say:

"This natural ground slipped and carried the wall with it, and to show the absurdity of all past conjectures, how totally at variance they are with the facts, it is only necessary to state that the whole wall fell as a solid block."

And concludes "flat footed" as follows:

'The best engineer in the world could not have foreseen such a possible danger."

We have no doubt that our Arkansas contemporary is sincere. He seems to have the "courage of his opinions," and any one who sees no contradiction in discovering various other strata below "primitive" rock would have little diffi-culty in believing anything. For the inhabitants of Little Rock in general, and for Colonel Zeb Ward in particular, we have only the sincerest sympathy. If the *Press* keeps on this way Colonel Ward will appreciate the saying, "Save

me from my friends," and may live to regret that the flood did not carry off either him or his journalistic defender.

As for the Little Rockians, they may as well, if the Press is right, forego all thought of any water-works of their own. Other cities may rejoice in sparkling reservoirs and aspiring stand-pipes and sit every man under his own shower-bath, but it is not for them. They must continue to work the slow, laborious pump-handle, because between Nature and the Arkansas Press "the best engineer in the world cannot foresee a possible danger" in that locality, and who in that case would be fool enough to start another reservoir or rebuild the ruined one?

In order to make ourselves clear to the citizens of Little Rock, we should state that it seems that the contractor's masonry was good, but there is no evidence that either he or the local press realized that it is of the utmost importance that a skilled engineer should be employed to design the section of the dam, and this cannot be done intelligently until he knows precisely the character of the foundation upon which it is to rest. When these precautions are taken and properly acted on, Nature is not apt to play a trick on the contractor.

SEWER-WORK AND A CITY ENGINEER.

WE notice that an ordinance is now pending before the City Council of Minneapolis making radical changes in the Sewer Department. The sewer-work has heretofore been done under the direction of the City Engineer. It is now proposed to take the entire control of the Sewer Department out of the hands of the Engineer and to place a new official, to be known as the Superintendent of Sewers, at the head, he to appoint the sewer inspectors and foremen, etc. There appears to be no fault found with the City En gineer, and it looks very much as though this was an attempt to let politics creep in.

City Engineer Rinker made a strong protest against the ordinance when it came before the committee, saying that its passage would place him in a position in which he would be held responsible by the public for work over which he

could not have the slightest control.

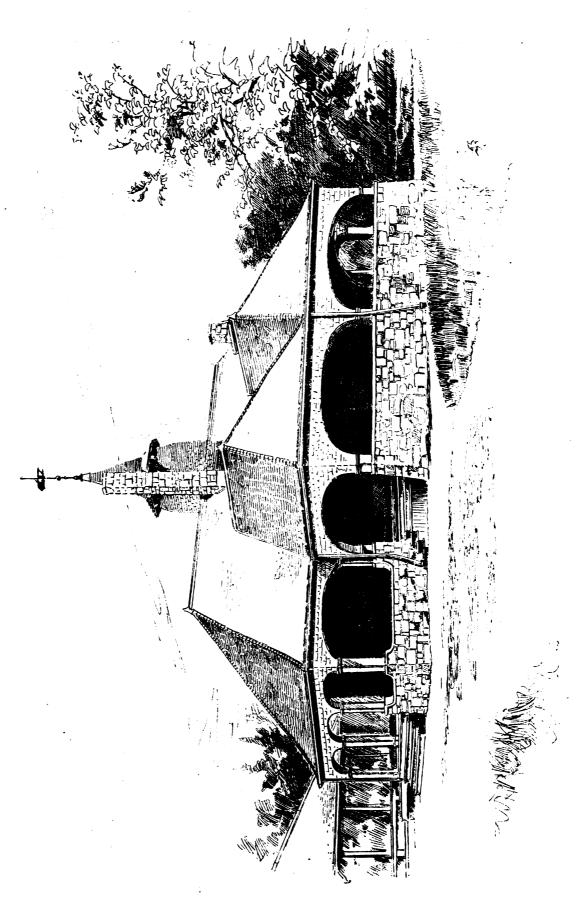
We do not know what is at the bottom of this move, but it looks very much as though the Sewer Department, constantly having new work to do, has some patronage at its disposal which some politicians want to control. In any wellregulated municipal engineering department we should consider that the City Engineer should certainly have control of the sewer-work.

RIVER AND HARBOR WORK OFTEN MISREPRESENTED.

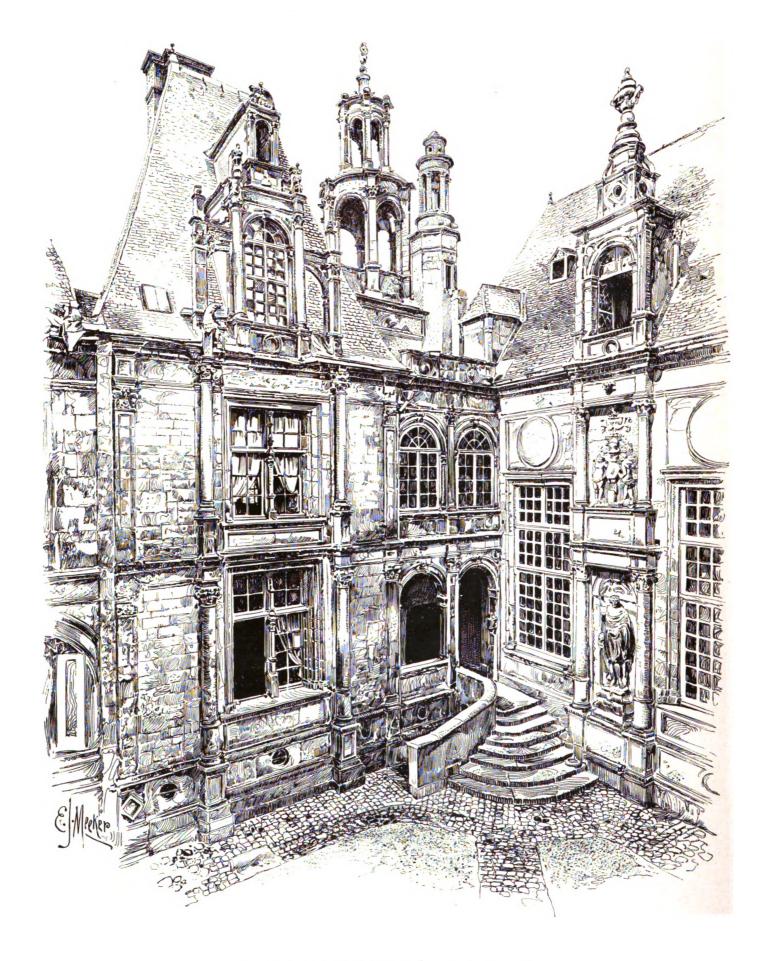
English contemporary, Engineering, recently, in discussing our expenditures for rivers and harbor improvements, said:

"The United States Congress annually votes certain sums to be expended in carrying out public works, such as harbor and river improvements. It would appear, however, that but little is done to determine, before passing the vote, whether such streams and harbors are really capable of improvement, for not unfrequently orders have been given to improve the navigation of streams which were never, in the best seasons, more than two or three feet deep, and, in fact, one case is recorded in which the sum of \$75,000 was voted for the improvement of two streams which, so far as could afterwards be discovered,

O



AILROAD STATION AT BUENA PARK, ILL. - BURNHAM & ROOT, ARCHITECTS.



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had no existence apart from the imagination of some Government official. On the other hand, in dealing with places like New Yorkand Baltimore the utmost parsimony is shown, and necessary improvements delayed for years, through the omission of Congress to supply the necessary funds."

The streams referred to above are the Clark and Mingo Creeks, and Captain William H. Bixby, of U. S. Engineers, in charge of the district in which they are, sets the matter right in a letter under date of December 10, 1887, to the Engineering News, in which he says: "You say, '\$75,000 was allotted for these streams.' matter of fact, no money has been yet allotted for the improvement of these streams, and only about \$400 for their examination and survey. Of Mingo Creek he further stated: "A steamer of 80 feet length, 30 feet width, and 5½ feet depth of hold, and about 80 tons burden, was then [at the time of his examination] making bi-weekly trips over the greater part of this river and carrying about \$365,000 worth per year;' and of Clark's Creek Captain Bixby says: "It is never dry, and during the greater part of the year is from 100 to 200 feet wide and from 9 to 12 feet deep."

It seems to be true that Congressman Aiken, of South Carolina, intimated that these creeks are streams "into whose beds water must be dipped from elsewhere to establish a commercial stream." The story grew out of the fact that the orders for the survey were sent by mistake to the engineer of another district, who, of course, failed to find the streams in his territory or on

his maps.

Streams and harbors are undoubtedly improved here as elsewhere which before improvement have at points but two or three feet of water in The source of the Chicago River had but four or five feet of water before it was improved; Buffalo Creek had but about three, and many of the lake harbors had even less depth at the mouths of the creeks forming them. The depth of a stream at its shallowest point is merely a matter of the estimated cost of the improvement. The total cost of the improvement and the probable accruing traffic are the two elements to be considered before commencing work.

Sir Charles Hartley says of the Rhine: "At certain places, at extreme low water, in dry seasons, the available depth is not more than two feet, in spite of the large sums of money which have been spent by the German States during more than half a century on regulation works of magnitude;" and it is understood that the magnitude;" Clyde below Glasgow was, before dredging,

fordable at low water.

Captain Bixby, in a letter to the Wilmington Review, which should be made a part of his official report, shows that an expenditure of \$462,000 applied to nine Carolina rivers and creeks has improved 582 miles, and the increased commerce on these streams amounts to \$8,150,000 annually, or an expenditure of \$800 permits a yearly traffic of \$14,000.

Although Engineering does not mention it, charges are freely made, by men of the Congressman Aiken type, that the passage of our River and Harbor Bill is accompanied by corrupt practices, and that a large proportion of the appropriations are for streams which will never become portions of any commercial highway.

Persons making such statements have been challenged repeatedly to show that five per cent. of the total money appropriated by Congress has been for such streams, and we believe the chal-

lenge still remains unaccepted.

In 1808 Secretary of the Treasury Gallatin said in a report to the Senate: "Justice, and perhaps policy no less than justice, seems to require that a number of local improvements sufficient to equalize the advantages should also be undertaken in those States, etc." The principle laid down by the Secretary has led to what is called "log-rolling," in which a small interest is aided by a larger one, or several small interests combine, but the corruption, if any exists, emanates from railroad interests, which object to the low freights necessited by efficient water communica-

The reason that New York is treated with parsimony is that New York is regarded as the centre of railroad influence and therefore as the headquarters of opposition to the improvement of rivers and harbors

Warner Miller, when Senator, stated the position to a *Tribune* reporter thus: "New York can get this appropriation of \$1,000,000 to start the Sandy Hook improvement, or she can let it alone and go on fighting the River and Harbor

Indiscriminate attacks by New York papers on proposed improvements in localities other than right at their door have destroyed much of their influence with Congress.

NO MORE BUILDINGS ON CITY HALL PARK.

WE are pleased to notice that Mr. Crosby has introduced in the Legislature a bill forbidding the city authorities to erect the new municipal buildings in the City Hall Park, and we hope it will be speedily passed. As the Tribune says: "The feeling that the only open space in the city between the Battery and Washington Square should not be encroached upon to the extent of a single square inch, has been shown unmistak-Whenever additional city buildings are needed the city should go elsewhere for a site.

STREET RAILROAD COMPANY CLAIMS DAMAGES FOR A STREET OPENING.

THE Broadway and Seventh Avenue Railroad Company has made a novel claim against Mr. Iames Fav. a plumber, of this city. Mr. Fay had occasion to make a connection with a sewer in Greene Street, and for this purpose was obliged to open the street, for which he had a permit from the Department of Public Works. The Railroad Company found it necessary to send a man to conduct the horses of each car around and past the opening. For this man's time the company has sent a bill to Mr. Fay, which, he refusing to pay, they threaten to sue for. It will be interesting to note the result of such a suit.

A PUBLIC meeting of prominent citizens of Augusta, Ga., was recently held to thank Congressman Barnes for the part he had taken in securing an appropriation for the Savannah River. A committee was appointed to use their influence in Washington and to secure appropriations for the carrying on of this improvement, which is deemed of such importance to the commercial prosperity of the city of Augusta.

NEW YORK ARCHITECTURAL LEAGUE MEMORIAL BELL AND CLOCK TOWER COMPETITION.

THE following were the awards in the "Memorial Bell and Clock Tower" Competition for the gold and silver medals of the Architectural League:

The Gold Medal-James A. MacLeod, Minneapolis,

The Silver Medal-William B. Mundie, Chicago, Ill. Honorable Mention-Julius Harder, New York City; William C. Noland, Philadelphia, Pa.; Timothy F. Walsh, Cambridge, Mass.

Forty-four sets of designs were received, and forty-three considered, one-signed with a monogram composed of two E's-being thrown out for non-compliance with the conditions.

The jury was composed of Richard M. Hunt, Charles F. McKim, and Russell Sturges.

NOTICE.—The author of the design bearing cypher three circles interlacing forming trefoil is not known. He is requested to send his address to Charles I. Berg, Secretary, 10 West Twenty-third Street, New York City.

OUR ARCHITECTURAL ILLUSTRATIONS. HOTEL DE LA BOURSE, CAEN ERANCE.

RAILROAD STATION AT BUENA PARK, ILL. - BURNHAM & ROOT, ARCHITECTS.

"OLD COLONIAL ARCHITECTURE AND FUR-NITURE."

UNDER this title Mr. F. E. Wallis has produced an extremely interesting and well-drawn collection of sketches and measured drawings of American work of the last and early part of the present century, together with some few examples of furniture such as were brought over from England by the earliest colonists of Massachusetts Bay. The examples are not only of early New England architecture, with much of which most architects are familiar but of less familiar work in the Middle and Southern States, which latter section has been little noticed, until THE ENGINEERING AND BUILDING RECORD published several interesting sheets of detail of such work now existing in the South, secured for it by the author of this work. It is interesting to note the variations in the work of the several localities.

In New England and Virginia there is much the same spirit. The work is English in character in both sections. but that of New England differs enough from its English prototypes to show that there were skilled workmen in that part of the country who worked with some degree of individuality, while the Virginian work is so evidently English in spirit as to confirm the traditions that most of the interior fittings and architectural features were executed by English workmen and sent to Virginia from the mother country.

Judging from the examples here shown, the Viginian work is much more elaborate and finer than anything that now, at least, exists in New England.

The old work of Maryland shows in as marked a manner the influence of French taste as its next-door neighbor shows its English origin. It seems not too bold an assumption that this difference was due to the fact that Maryland was settled by Roman Catholics and by Scotchmen. The Roman Catholics would naturally have strong intellectual and artistic sympathy with France. While the art of Scotland has always been influenced by that of France, and the relations between these two countries had been particularly intimate during the Jacobean period which immediately preceded the time of colonization.

The New York work has again a different manner, which Mr. Wallis, perhaps justly, ascribes to Dutch influences.

After the Revolution the work in the various sections is more akin than during the Provincial period. Most all this later work is strongly affected by French taste.

We miss in Mr. Wallis' book any systematic arrangement of the plates in regard either to subjects or localities. It is also to be regretted that he should so unreservedly have used the title of "Old Colonial," a misnomer only a degree less objectionable than that of "Queen Anne."

In the use of the word in an historical sense, very little of the work here illustrated is of the "Colonial" times: the bulk of the examples are of the "Provincial" period, while one-third of the plates show work executed shortly after the American Revolution and even later.

It seems to us well that the student should in the study of this old work, as of any other, not lose sight of the different social influences existent during these several periods.

What we have said in criticism of Mr. Wallis' choice of title is in no wise to be taken as in disapproval of his choice of subjects for illustration.

Indeed, the richest and best of the old work is that of the "Provincial" period, and the post-Revolutionary work here illustrated is very interesting and suggestive, and could ill be spared from the collection.

The later work is closely akin to the older, and all has the interest that pertains to the work of the handicraftsman before the use of machinery had robbed him of his sense of fitness, refinement, and proportion, and hence of any power to design his own details.

Mr. Wallis' sketches are executed in an artistic and very workmanlike manner; an architect himself, he has so chosen and presented examples of this work that they will be of very great service to the architect, while being none the less interesting to the amateur and the antiquarian.

Messrs. George H. Polley & Co., of Boston, are the publishers of the work. The price of one volume of sixty plates, bound in white cloth, with leather back, is \$25.

THE first day of the twentieth century will be Tuesday, January I, 1901.



PAVEMENTS AND STREET RAILROADS. No. XXVI.

(Continued from page 86.)

REPAIRING, CLEANSING AND WATERING.

THE following items are from the annual report of Mr. George R. Strachan, Surveyor to the Parish of Chelsea, London.

Complaint is made of an insufficient number of streetbasins, and that the gutter stones, from not being laid on concrete, have settled under heavy loads, so as to form depressions which hold the water. He states the axiom, that "a street on which water gathers is a dirty street, and a dirty street is an expensive street." The use of flints on macadam roads is condemned as being "dusty in summer and dirty in winter" under heavy traffic. Good granite is recommended, but not such as breaks into sharp, razor-shaped pieces. Large stones are a positive evil, and it requires much care to insure that the stones do not exceed two inches in the largest dimension. The paragraph on the wastefulness of macadam roads for streets carrying heavy traffic is worth quoting entire:

"Broken granite at its best is very wasteful as a material for maintaining carriageways where heavy traffic exists. A cubic yard of Guernsey granite costs the Vestry 125, 6d, on the wharf this year. The cartage of it to the carriageway, spreading, rolling, and consolidating it costs 95. 6d. more, or a total of 225. on the finished carriageway. It is there ground to dust in dry weather, and to mud in wet weather, and becomes, taking an average of all weathers and of the traffic weights in Chelsea, four cubic yards of slop or mud. These cost 105. 4d. for sweeping to one side of the carriageway, 65. for carting to the wharf, and then 45. 5d. for their disposal. From first to last the cubic yard of Guernsey granite has cost £2 25. 9d. In roads like King's Road one year's wear is the utmost that is obtained from it. The average life in the home district is obtained from it. The average life in the home district is only four years. The temporary use of the material at the large cost named brings vividly to the mind the un-scientific and wasteful character of macadam roads in heavy traffic, and points to the necessity of using a better and different class of material for carriageways in main thoroughfares.

As to the value of steam road-rollers the report states, that, after a contest in the courts, the right to use them has been maintained, the gas company having sought to restrain them on account of damage to pipes. One of twelve tons and one of ten tons are now in use, at a cost for each of 10s. 6d. per day, including driver, fuel, oil, etc. By the use of one 300 square yards can be finished per day, with a great saving to tradesmen on a street by the shortening of time occupied in repairs. Repairs by simply throwing stone loosely on the surface and depending on traffic to pack them is considered a cruelty to horses and an inconvenience to the public. Two gasmains have been cracked by the rollers, but the insignificant cost of their repair bears no comparison to the saving by the use of the rollers.

The following statement is given of the actual cost of repairing Harrow Road, the area repaired being 9,522 square yards:

•	£	s.	d.
Estimated cost	300	•	6
ACTUAL COST.			
477 scores	35	15	6
403 tons granite	311	14	1
216 yards hogging	52	4	0
13,500 gallons water		10	135
76¼ days horse hire	34	6	3
Labor	48	4	10
Roller.			
Maintenance (2 per cent. on £375)	3	15	0
3,500 galions water		,	715
Half ton coal		9	11/2
125 bundles wood		4	415
Six chaldrons coke	2	14	0
Æ	390	•	,
Below estimate	•••	•	

Cost per square yard, 9.82d. Average area rolled per day of 10 hours, 423% square yards, Average thickness of granite, about 1.38 inches

As to wood pavements, some which have borne a traffic of 550 tons per yard in width during sixteen hours per day for seven years are good for some time to come. These pavements wear most at the sides of the road where the water lies on its way to street-basins: the surface also wears uneven in the older portions. Hard wood has not proved satisfactory; when one block is defective it wears more rapidly than adjacent ones, and cup-shaped depressions are formed, instead of saucer-shaped as in the softer woods.

Of asphalt pavements Mr. Strachan says: "I venture to state that there is not a pavement in use so economical, healthy, and clean, and with so many advantages as asphalt. Its one disadvantage of slipperiness does not, in my opinion, outweigh its advantages.

The various carriageways now paved with it are in better condition than when first completed. "They make no mud, and are always wholesome. A heavy rain washes them clean, and an extra watering attains the same end."

The footways paved with asphalt mastic one inch thick are spoken of in the highest terms, although compressed asphalt is undoubtedly most durable.

The trouble from cracks in the latter and methods of overcoming were treated of in previous articles.

Flag-stone footways allow water to percolate through the joints into cellars unless they are laid on concrete.

"The main streets are swept daily, others three times and twice a week according to their importance. Six gangs of men are engaged in this work, and are assisted by four sweeping-machines and three scraping machines whenever practicable. The wood pavement is washed during dry weather, and the slop occasioned thereby is removed as quickly as the present system allows of. Street orderly weather, and the stop occasioned thereby is removed as quickly as the present system allows of. Street orderly men are regularly employed on the wood pavement to remove the horse-manure and the refuse. During the year 19,695 cubic yards of slop and street sweepings have been swept from the streets, and have been carted to the wharf at 2s. 3d. per load. These were shot into barges, and removed at the 8d per load.

swept from the streets, and have been carted to the wharf at 2s. 3d. per load. These were shot into barges, and removed at 1s. 8d. per load.

"By contract, the carts are to call at every house once a week at least, and the men are to ask for the dust. The system followed when an application is made for the removal of dust is for an inquiry to be made as to why it was necessary. If the contractor is at fault, he is informed of necessary. If the contractor is at fault, he is informed of the fact; if the servants have refused to allow the men to take away the dust when they called, their master is informed of that fact; and if the householder has been averse to having it removed weekly, he is urged on the ground of health to allow it to be taken each time the men call; and by these means it is endeavored to secure a regular and weekly removal of all the household refuse.

"The collecting contractor is instructed not to collect trade refuse as dust, and a strict watch is kept on what he delivers to the wharves

"The public grumbles at the local authority for its neglect in the removal of dust, yet they put out of the reach of the local authority the only means of doing the work well. The custom of tips is the curse of local effort. It demoralizes the men, it causes them to act dishonestly in removing rubbish that ought not to be otherwise disposed of, and it inflicts a great hardship on the poor."

For street-watering the price paid for water is od. per 1,000 gallons, and the cost has been £65 19s. 10d. per mile watered.

"Street-openings by gas and water companies cause damage to the roads and are an annoyance to the public. They may be necessary for the business of the companies as at present conducted, but they are an injury to the roads. I am convinced that sooner or later the local authorities of the metropolis will have to take united action for their own protection against the powers and customs of these bodies. I have already referred to the steam-roller case where the law has subordinated the rights of the public in the repair of the streets to the rights of these commercial undertakings. At the close of the year the law has been held to make the public liable for personal injury under the following circumstances: A water company placed an iron box in a York stone footway under their statutory powers. In time the stone wore below the level of the iron box and an unfortunate pedestrian tripped up over it and sustained serious injury. He brought an action for compensation, and it was held that the local authority was liable. In this case the local authority cannot successfully refuse to have the iron boxes fixed in their pavements, and yet they are required to keep the pavements up to the boxes. If the boxes were not there the pavement would wear equally and no injury would be caused. This is a serious liability. I have not objected to the Chelsea Water-Works Company inserting such works and apparatus as they deem necessary in the streets, but if these liabilities are to be thrown upon the vestry, it will be my duty to draw the attention of the vestry to the question. It is no light matter to engage in lawsuits with these companies, when one of them can spend £100,000 in law, and then pay 10 per cent. to its shareholders out of the annual revenue."

(TO BE CONTINUED.)

THE STRENGTH OF COPPER PIPES AS AFFECTED, BY HEATING.

It will be remembered that on the 19th of September last the steamship "Elbe," belonging to the Royal Mail Steam-Packet Company, while on her trial trip burst her main steam-pipe, killing ten men, no one escaping alive from the fire-room. As the pipe had been carefully made and tested to much above the pressure at which it burst, the accident was much discussed and its causes carefully investigated.*

We take the following from an extended report made to the Committee of Lloyd's Register by Mr. William Parker, Chief Engineer-Surveyor, and published in Engineering, believing that it will be of much interest to all makers and users of large copper pipes exposed to high pressures and temperatures. Mr. Parker says:

It has long been known that at certain temperatures which copper is very often subjected to during the process of working, it becomes very brittle; and it is also known that the range of temperature from the point of brittleness

that the range of temperature from the point of brittleness to the point at which copper is brazed is not very great, and that it is not an uncommon thing to burn a pipe during the operation of brazing.

In order to obtain some information on this point, and to ascertain something more definite on the behavior of copper at various temperatures, I had some experiments made on flat strips of copper.

1. I had a piece of good copper taken from a sheet, bent

I had a piece of good copper taken from a sneet, bent and broken cold.
 A similar piece was heated until it became red-short, and broke with its own weight.
 A piece was heated to about the above temperature,

allowed to cool and then broken cold.

4. A piece was heated to a temperature a little below that of the last specimen, and partially broken while hot, allowing the remaining part that was still holding to cool and then be broken.

The fractures of these pieces of copper are very interesting. The first piece broke with a silky fibrous fracture, the second, of course, was black from the effect of the fire, but in the case of the third piece, that had been raised to about the same temperature as the second one and allowed to cool before being broken, its tenacity and ductility were to cool before being broken, its tenacity and ductility were almost entirely restored. This experiment was repeated by testing some pieces in a testing machine, when the strength of the copper in its normal state was found to be 35,212 pounds per square inch with an elongation of 40 per cent. in a length of five inches, and having a contraction of sectional area of 39.9 per cent. After being burnt, then cooled and tested, the tenacity was only reduced to 31,337 pounds, and the elongation and reduction of sectional area were practically the same as that of the copper that had not been burnt. This experiment was repeated with copper strips that had been heated to a brazing heat, and other temperatures with similar results. and other temperatures with similar results.

and other temperatures with similar results.

The behavior of the fourth piece, and the appearance of the fractures were still more interesting. It was partially broken through while hot, and the appearance of that part of the fracture was discolored by the action of the fire; but the part that was allowed to cool had its ductility restored, and afterwards broke with a bright appearance. This experiment was repeated a number of times with similar results, and the appearance of the fractures corresponded exactly with the appearance of the fractures. corresponded exactly with the appearance of the fractures of not only the exploded pipe, but also the fractures of the other pipes that were experimented upon, and burst at pressures of 600 pounds and 780 pounds respectively. The only difference in these fractures was the depth to

which the crack, as shown by the discoloration, had extended, so that the appearance of the fractures of the exploded pipes and the pipes experimented upon was reproduced artificially by burning the copper and treating it as described.

From this it will be seen that a copper pipe may be overheated or even burnt in the process of brazing, and still the properties of the material be restored after it has cooled.

It might also be partially cracked through the copper It might also be partially cracked through the copper when at this dangerous heat, and that the crack would exist in a latent state and not be discovered until the pipe gave way. The small part of the material remaining intact being sufficient to hold the pipe together, and stand the hydraulic test of twice the working pressure without showing any signs of weakness.

The evidence given at this inquiry, and the experiments made during the course of the investigation, clearly point to the fact that an element of danger exists in the present practice of brazing large heavy copper pipes intended to

practice of brazing large heavy copper pipes intended to be subjected to such high pressures as are now so common; it is generally admitted that welds or brazed joints in any material must possess certain elements of uncertainty, and in the case of copper worked over a fire, these elements of uncertainty, as the above tests show, are greatly increased and should be eliminated.

and should be eliminated.

It becomes a question in my mind whether large steampipes such as these, intended for high pressures should not be worked cold, and instead of being brazed over a fire, riveted with butt-straps or lap-joints, or if copper cannot be riveted steam-tight to withstand these high pressures, whether it would not be wise to use solid drawn and the steam of the pipes or perhaps steel pipes, or perhaps even brazed pipes served with steel, copper, or brass wire.

A SANITARY convention will be held at Akron, O., by the State Poard of Health on January 25 and 26. Nineteen subjects are to be presented for discussion.

^{*}The pipe was 9% inches internal diameter, brazed together with a lap joint, the thickness of the copper being .276 of an inch. It had been tested on two occasions to 300 and 350 pounds per square inch, respectively. The pressure at the time of the explosion was about 150 pounds per square inch and had been at that point for tea hours or more.



不透射量与原料的工作用的形式的

THE CEMENT-TESTER AT THE POUGH-KEEPSIE BRIDGE.

THERE have already been used in the Poughkeepsie bridge substructure over 60,000 barrels of cement, of which 40,000 were required for the crib and caisson works and 20,000 for mortar and concrete filling of the masonry.

At least one barrel in every ten was tested, and, as many samples were prepared for treatment under different conditions and breaking at different ages, the work of testing was very considerable, and an easy, rapid, and efficient method was quite important.

Mr. J. F. O'Rourke, engineer in charge for the Union Bridge Company, devised the machine here illustrated, which was built by ordinary mechanics at a total cost of less than \$100 and works easily, rapidly, and very satisfactorily, and has tested all the cement used in the work.

Briquettes are prepared having a minimum sectional area of exactly one square inch; they are inserted in the jaws of the machine and contact secured and the scale-beam leveled by a slight movement of the eccentric shown in the end view.

The index weight is then rolled out until the sample breaks. If the sample resists the maximum strain due to the index weight it is rolled back to zero and a weight hung on the end of the beam sufficient to give a strain of 100 pounds on the sample. The operation is repeated until the specimen breaks, when the beam falls and the index saddle descending is engaged by its shoulders on the top bars of the frame, and, with the addition of the weights at the end, registers the breaking load.

In regard to water-waste and its consequences the report says: "The experience of all cities that we are in communication with, and where works have been in operation for any length of time, goes to show the damaging consequences attending reckless waste of water.

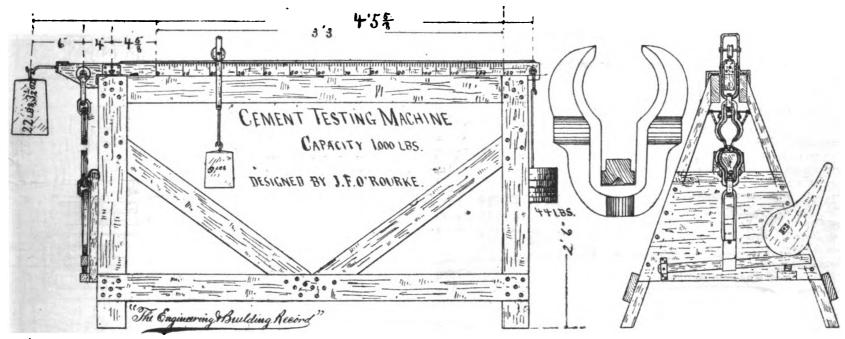
'But some will say, 'The works are owned by the city; we pay for the water, and we will use as much as we please, for it costs nothing to run it down hill; the works are no use if we cannot run all we please.' But they forget that the principal part of our interest account is for bringing the water to the city, and when they are allowing their taps to run in the winter to prevent freezing, instead of shutting off in the cellar, and in the summer to bring it cool from the mains, they are surely assisting to raise their own taxation for new mains, when the pressure for fire-service has become inefficient by the heavy draft on the gravitation main. When we take into account that water-closets alone under our pressure are capable of wasting about 10,000 gallons of water in twenty-four hours when they are kept open to prevent freezing, or with the mistaken idea of flushing the soil-pipes, and a 1/4-inch hose-jet over 15,000 gallons in the same time, it is easy to account for a water-supply running away before the city arrives at the size contemplated at the construction of the works."

The report cites the experience of Rochester, N. Y., and quotes the recommendation of its engineer, J. Nelson Tubbs, "That the city, at its own cost, should apply meters to all services."

Some of the meetings it will be noticed were exceedingly close, the error in one tunnel nearly a mile and a half long being only about one-eighth of an inch in line and grade, while in another considerably over a mile long there was no error in line and that in grade was not much more than one-thirty-second of an inch, although, as might be expected, the errors in line are usually much greater than those in grade.

THE WALLED LAKES OF IOWA.

THE Chicago Inter-Ocean says: "Along the watersheds of Northern Iowa there are a great many small lakes varying from half a mile to one mile in diameter. One of these in Wright County, and another in Sac County, have each received the name of "Walled Lake" on account of embankments that completely surround them. It has been generally supposed that these embankments were thrown up by the ancient inhabitants of the country. They are from two to ten feet high, and from five to thirty feet in width. Some who have examined them, however, declare them to be the result of natural causes only, and ascribe them to the periodic action of ice, aided to some extent by the force of the waves. The lakes are very shallow, and in winter they often freeze to the very bottom. The ice freezes fast to the earth below, and as in its expansion it acts in all directions, from centre to circumference, a certain part of alluvial deposit is forced to the shore, and this going on from year to year, and from century to century, has created the natural embankment.



The capacity of the machine is nominally 1,000 pounds, but it might readily be used to a much higher limit. It is very sensitive and has an initial error of less than five pounds. It occupies little space in operation, is very light, and designed to be readily taken apart and compactly stowed for transportation.

ANNUAL REPORT OF THE WATER-WORKS OF ST. CATHERINES, ONT., FOR 1886.

WE have received this report from the Superintendent, Mr. J. Albert Mills. It shows receipts for the year of \$7,992.65, and expenditures for maintenance and salaries of \$2,995.49. There were in use at the close of the year 19 miles of pipe, 145 hydrants, and 989 service connections. To avoid bursting the water-mains by too sudden closure of hydrants, when used by some careless driver of a sprinkling cart, ten "improved water-columns" have been put up from which to supply these carts, and the hydrants are not now opened except for fires. It is recommended that a fine be imposed for using the hydrants as hitching-posts, by which the nozzle-cap chains and their fastenings are sometimes broken or the joints started leaking.

The use of willows for holding up the banks of the canal was not a success, as the clay was too hard for the roots to penetrate.

An enlargement of the distributing reservoir is recommended, so that enough clear water may be stored to give a supply during the lengthy periods when the Beaverdams Creek is turbid.

MEETING OF HEADINGS ON THE NEW CROTON AQUEDUCT.

THERE are 44 tunnels on the New Croton Aqueduct, of which, on January 1. 1888, the headings had met in all but six, only one of which was over a mile in length.

Of those in which the headings have met, fifteen are more than a mile long, and their lengths and errors in line

and grade are given in the following table:

Headings.	Date of Meeting.	Error in line (feet).	Error in grade (feet).	Distance be- tween shafts (feet).
t S. and 2 N	November 19, 1887	0.00	0.014	6399.5
2 S. and 3 N	November 1, 1887	0.05	0.038	6199.4
3 S. and 4 N	October 8, 1887	0.27	0.025	6540.0
4 S. and S. N	September 16, 1887	0.71	0.010	6500.0
5 S. and 6 N	July 13, 1887	0.33	0.018	0408.4
6 S. and 7 N	April 27, 1887	0.00	0.035	6008.7
o S. and to N	February 25, 1887	0.229		6444.0
to S. and it A. N	May 10, 1687	0.464	0.010	7580.0
11 B. S. and 12 A. N	July 15, 1887	0.010		7568.0
14 A. S. and 15 N	July 22, 1887	0.00	0.003	5086.2
15 S. and 16 N	July 20, 1887	0.80	0.027	7850.0
16 S. and 17 N	March 5, 1887	0.30	0.050	7000.0
	May 26, 1887	0.010	0.021	6032.0
20 S. and 21 N		0.025		5425.0
21 S. and 22 N		0.010		6926.0
		. 1	٠,	•

The second one, "2 S and 3 N" is the one where the drills met November 1, 1887, as described in our issue of the 26th of that month, and the meeting of the first one, "I S and 2 N" on November 19 was mentioned at the

ENGINEERS' CLUB OF ST. LOUIS.

THE club met January 4. President Holman in the chair, W. H. Bryan, Secretary, twenty-four members and two visitors present. Robert H. McMath, J. W. Schaub, James M. Sherman, A. W. Hubbard, and Joseph F. Porter were elected members.

A paper by Mr. Charles H. Ledlie, entitled "Construction of Dam and Reservoir at Athens, Ga.," was read. The method of carrying out the work was given in detail and sketches of the principal features were submitted. The protection of this kind of work against crawfish and muskrats was shown to be of prime importance. Messrs. Moore, Holman, Johnson, and Flad took part in the discussion.

Professor Nipher then read a paper on "The Volt, the Ohm, the Ampere—What Are They?" being a mathematical discussion of the subject. The results were shown and their value to the electrical engineer explained. The paper was illustrated by suitable apparatus and drawings. Messrs. Holman, Flad, Moore, and Seddon participated in the discussion. Papers by N. W. Eayrs and Professor C. C. Brown announced for the next meeting. January 18.

Engineering of December 23 contains an illustrated account of a 1,000-ton hydraulic shears, built by J. Copeland & Co., cf Glasgow, for the Dumpeller Steel Works, for cutting steel blooms. It is capable of cutting steel slabs 30 inches broad by 10 inches thick at the rate of four cutto per minute.



THE NEW HARLEM RIVER BRIDGE.

This bridge, authorized by Act of Legislature, June 11, 1885, is now in an advanced stage of construction, and at the time of preparation of our maps, sketches, and plans, a few weeks since, the field-work was at a stage when all the different classes of operations were in full progress, and the extent, variety, and detail of methods and appliances well illustrated. No important portion had been completed except the caisson under Pier 2, which was accomplished by the ordinary methods of good pneumatic work.

The erection of the bridge is in charge of Commissioners Jacob Lorillard, Vernon H. Brown and Davil James King, with a corps of engineers, consisting of William R. Hutton, Chief Engineer; William J. McAlpine and Theodore Cooper, Consulting Engineers; John Bogart, Resident Engineer.

The entire contract was let for \$2,055,000 to the Passaic Rolling Mill Co. and Myles Tierney. The former construct and erect the iron superstructure, the foundations

Barr, sub-contractors, was completed end of April, 1887. Erection of iron work commenced about September 1, 1887, and steel arch, span No. 2, was closed December 17, 1887.

The prosecution of the work has been vigorous and successful, its construction sound and thorough, and its progress unusually free from accidents or unforeseen difficulties, except a greater amount of rock excavation under Pier 2 than was anticipated from preliminary rod soundings.

The work at site is notably interesting as an undertaking of much magnitude under plain, ordinary conditions, involving much high and heavy false work, and the handling and hoisting to a considerable height of many weighty pieces. The broken and precipitous ground and rocky banks, the necessity of preserving unimpeded traffic on the railroads and river underneath, and the limited and inconvenient yard-room, were the principal difficulties encountered.

Steam-power has been used wherever practicable, and

On the west side cars are drawn up the irregular incline by a wire cable wound on drum of an 8½ xto-inch Lidgerwood hoisting-engine.

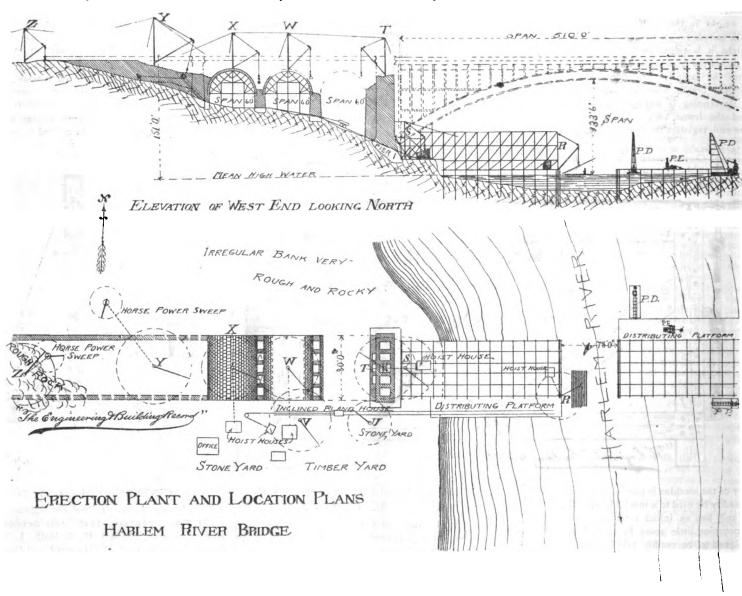
Materials for concrete are delivered by derrick L to steam-mixer C M, which automatically discharges into a hopper, from which it is received into buckets which are carried on small platform cars to the foot of the proper derrick.

Timber is received by raft or barge and is either removed from the dock to the place where it is to be used or stored in yard.

The iron is received on side track on east shore and deposited at foot of derrick, T D, or in yard, or upon skids, whence any members can be removed to points required for erection.

Members for span 2 are delivered to derrick T D, and transferred to car on distributing platform, which carries them to foot of hoist of erecting traveler derricks E T, E T.

There are hand-derricks in the yards at H, J, I, G, G, and U. Derricks A, Y, and Z are operated by horse-



and masonry being built by Myles Tierney. We give this week a sketch map and general plan of work, showing arrangement of plant and condition of work just before the last arch segments of span No. 2 were erected, and will supplement it in subsequent issues with descriptions and illustrations of the principal features and special details of the erecting plant.

The bridge is a public highway and crosses the Harlem River on the line of One Hundred and Eighty-first Street, New York City. It consists of two steel arches, each of 510 feet clear span, resting on granite-faced piers and abutments. The approaches are on masonry arches, with chambered spandrels, with gneiss rubble walls faced with granite. The bridge is graded in a parabolic curve from centre over main spans, and on tangents over the approaches.

All foundations are on solid rock, stepped off in horizontal planes; the eastern approach chiefly on concrete upon a softer rock.

Operations were commenced at the site in August, 1886, by Mr. Tierney. The submerged work, by Anderson &

the auxiliary structures and temporary work have been carefully designed.

As shown on the general plan, nearly all the excavation is completed, and the foundation courses laid, all but two of the approach arches have been laid, much of the sidewalls finished, main piers completed above the skew-back seats, one arch nearly closed,* and several segments of the other erected.

The total number of workmen at site is about 550, 300 of whom are employed by Contractor Tierney on substructure.

Three Rand drills at S D are supplied with steam from the adjacent boiler house near the end of the east approach, and the earth and rock excavation at both ends draws near completion.

Stone, cement, and other masonry supplies are received from the river and stored on the dock and in the yards indicated on the map, whence they are distributed as required and transferred to the structure by the mast and boom derricks A, B, C, D, E, F, F, S, T, W, X, Y, and Z.
*Span 2 has been closed and centres struck since this plan was made.

power, all others by steam.* The all-around derrick T D has an 8x12-inch Copeland & Bacon hoisting-engine; the erecting traveler derricks E T, E T, have an 8x12-inch hoisting engine built by J. S. Mundy, Newark, N. J., who also supplied those used in erecting the steel arch. The other hoisting-engines are nearly all Lidgerwood's make, from 6x8-inch to 8x12-inch,

Lerricks T, F, and P have the hoist-ropes carried down through the openings in the piers and led by sheaves to the hoisting-engines.

Derricks C, D, E, W, X, and Y, similarly have their lines led through the foot-block vertically down through the arch centre to the surface of the ground, and thence by sheaves to their respective engines.

There are two pile-drivers, P D, driving additional piles for the side false work, and a pile-driver engine, P E, for

^{*}These derricks have since been fitted with steam power, and an additional one set up near the one marked A. All but one of the 60-foot arches have also been turned, centering placed for the "7 centered" s6-footarch on east approach, and much progress made throughout the work.



hoisting timber from the water and erecting bents of false

A blacksmith and machine shop are located on east shore, the latter connected by a railroad track with line of bridge, and equipped with an engine, planing-machine, radial drill, punch, shears, lathe, and bolt-cutter.

The general arrangement of tracks, shops and derricks has been made with much care, and gives very satisfactory results in economy of time and labor.

FACTS ABOUT FIRES IN NEW YORK DURING 1887.

THE Fire Department of New York during 1887 answered 3,412 alarms, of which 98 were unnecessary, 132—were for indications of fire, and the rest, 2,912 for actual fires. Of these 2,634 were confined to the spot wherethey started and 173 were kept in one building, while only 37 extended to other buildings. Sixteen were on ships. Twenty-five buildings were totally destroyed, 101 considerably damaged, and the rest damaged slightly, or not at

Alcohol, tar, paints, etc., igniting 66
Cigars, pipes, etc 225
Defective building 75
Electric-light sparks 22
Fire-crackers
Fireworks 34
Foul chimneys, flues, and fire-places
Friction of machinery
Gas exploding, igniting 50
Gas-lights and stoves, candles, lamps, etc 254
Hot ashes igniting wood-work
Inflammable material igniting 2
Kerosene-oil lamps 474
Matches, tapers, etc
Miscellaneous 44
Naphtha, benzine, and gasoline vapor 22
Not ascertained
Spontaneous combustion of oily rags 59
Steam-pipes 12
Stoves, boilers, furnaces, grates, etc
Thawing out water-pipes with lamps 9

Four firemen were killed and 195 injured, and fourteen citizens killed and eighty-seven injured at fires. Of the

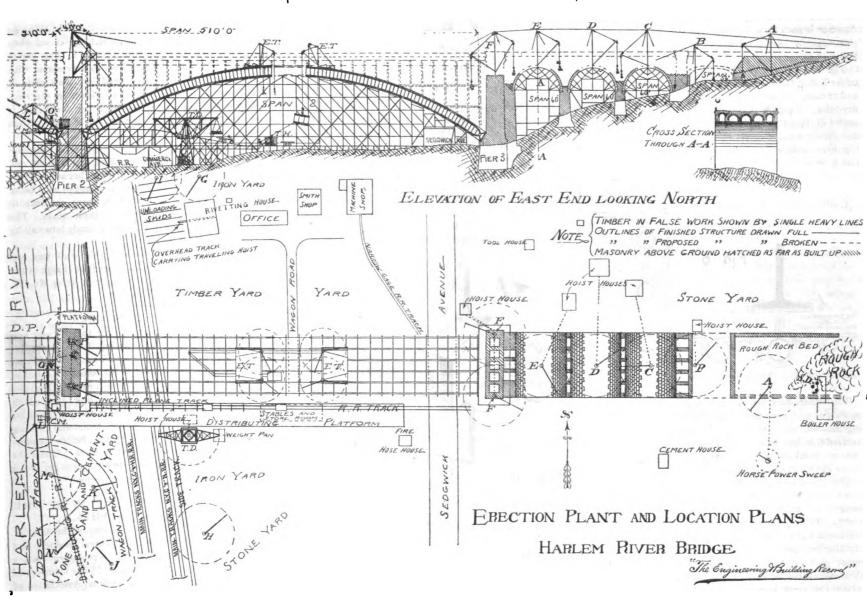
Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
	-						
January 14	23.30	18.62	20.42	30.76	28.36	24 96	31.50

AN ANGLO-ELECTRO-MECHANICAL BULL.

A VOLT-METER was recently ordered for the engineroom of an electric-light station at Chatham, England, with an 18-inch dial, so as to be readable at a distance of at least 40 feet; but, unfortunately, the only place where room could be found for it did not permit the observer to get more than two feet from the dial.



all. For the six years, from 1881 to 1886, 97% per cent. of all fires were confined to the buildings in which they started, and less than two per cent. of the buildings on fire were destroyed. Last year 98% per cent. of the fires were kept within one building, and less than I per cent. of the buildings were destroyed.

The estimated losses for the year on buildings were \$1,400,643, and on contents, \$4,171,862, a total of \$5.572,505, upon which there was an insurance of \$38,189,092. The uninsured losses were \$702,408. At eleven fires the loss exceeded \$100,000. The largest fire of the year was on May 27, when the Belt Line stables were burned, the loss being \$592,925. The burning of the Morgan Line pier in February, was the next largest conflagration, the loss being \$492,600. The third heaviest loss was that of the storage warehouse on West Thirty-eighth Street, \$345,325. After these no loss reaches \$200,000, the nearest approach being that at the fire at 221 to 227 Canal Street, on April 28, \$182,800, and at the Harlem fire of May 7, \$177,050.

The origin of the fires of the year was as follows:

latter only three deaths and no injuries occurred after the arrival of the firemen.

There were nine persons indicted, eight tried, and seven convicted of arson. The sentences varied from three years six months to sixteen years in State prison, except in one case where the prisoner was let off with three months in the penitentiary.

The department now consists of 960 officers and men, who make up fifty-three engine, nineteen hook-and-ladder, and two fire-boat companies. There are 338 horses in the department. An average of forty-four men are constantly on the sick-list.

Over 30,000,000 gallons of Croton water were used by the department during the year in putting out fires.

The Bureau of Inspection of Buildings considered plans for 4,344 new buildings, to cost \$67,068,200, and for 2,287 alterations to old buildings, to cost \$6,397,985. Only 2\frac{2}{6} per cent of the fires of 1887 were due to defective construction of buildings, as against 7 per cent. in 1880.

IS ELECTRIC WELDING RELIABLE?

E. J. RYVES, writing to the *Electrician*, states that the electric welding done at St. Petersburg and Paris is defective, the samples, though outwardly good, showing a very unsatisfactory state at the join when cut in sections, the metal being brittle and burnt where it had been under the action of the arc. He thinks it impossible to avoid burning the steel or iron more or less when the arc is used.

Some cut samples of electrical welding done in this country that we have seen looked very good but we should be glad to hear of any tensile or bending tests that have been made.

A SUGGESTION IN NAVAL NOMENCLATURE.

HER Britannic Majesty's new composite sloop has been named the "Buzzard." It will now be in order for our Anglomaniacs to memorialize Secretary Whitney to call our next new cruiser the "Skunk." It would be, at least, equally appropriate for offensive warfare.





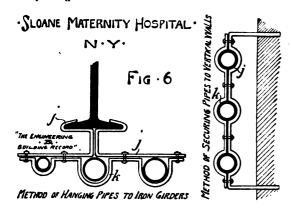
PLUMBING IN THE SLOANE MATERNITY HOSPITAL, NEW YORK.

No. II.

(Continued from page 106.)

The details of pipe system in laundry is shown in Fig. 5, and pipe-lines also in Fig. 1. The main pipe, G, runs through laundry at centre of iron beams, with a branch, I, extending down to boiler. The cold supply flows down boiler and out through pipe in bottom and up to waterback in range, returning hot into the side of boiler, thence passing out through pipe I to supply laundry-tubs with hot water. The cold supply to tubs passes through pipe I. Another branch from G runs down wall to range on the side opposite boiler, connecting with a copper clothesboiler at L.

The circulating-pipe, K, connects with cold supply under boiler, thence extending up back of boiler to ceiling and running parallel with J, connecting with it over laundry-tubs. A pipe branches from circulating-pipe K, near centre of laundry, and passes through heating-chamber and dining-room to recess C, thence up to attic, terminating over tank, and utilized as an expansion-pipe. This line is shown by K in Fig. 1. The laundry-boiler will hold thirty-five gallons.

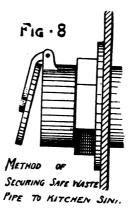


The laundry-tubs are secured by galvanized-iron pipes, as shown, with each end of pipe between the tubs entering into wall and securely leaded therein. Molded galvanized-iron legs support the front of tubs, and the rear rest on brackets of same material. A pipe runs also under the entire row of tubs.

The detail in Fig. 6 shows the method of suspending pipes from iron girders and to vertical walls. These hangers are made of galvanized strap iron, one inch in width. That part of the hanger indicated by j in the horizontal and vertical hanger is $\frac{1}{16}$ of an inch in thickness, and that indicated by k is $\frac{1}{16}$ of an inch in thickness. The upper part of horizontal hanger is made in two sections, which can be easily fitted on the iron girder, after which the lower part k can be put in position over the pipes and quickly fastened by bolts, and secured by nuts as shown. The inner section of vertical hanger j is let

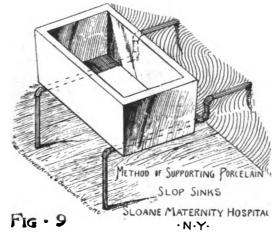
into brick wall and secured in position by lead filling: the outer section k is then fastened in the manner described above.

The detail of pipe system in kitchen is shown in Fig. 7. The boiler is made in two sections to permit it to receive the supply from both low and high pressure systems; the outer section containing the water from low-pressure and the inner from high-pressure system. All pipes shown in Fig. 7 suspended near ceiling are supported by pipe 1½ inches in diameter, with each end resting in brick walls, as shown in Figs. 1 and 7 at T'.



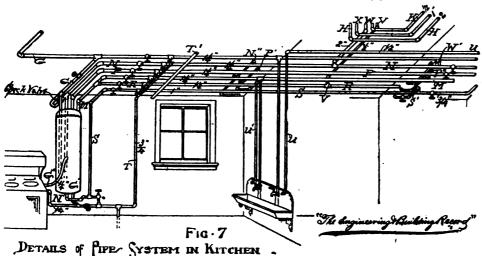
The water for supply to outer section of boiler enters through pipe G, passing down and out through pipe G', thence to water-back, and returning hot through G' into outer boiler, passes out through pipe M, furnishing hot water for fixtures in kitchen and adjacent rooms where required. The pipe M terminates in hall back of diningroom, as shown in Figs. I and 7. There are branches from G and M to kitchen-sink. Branches from G supply tanks for water-closets at D' and D'.

The expansion-pipe, R, branches from M near boiler, thence running parallel with M to dining-room hall, where



it terminates, as shown in Figs. 1 and 7. A pipe branches from R at V and runs up, terminating over tank.

The high-pressure supply from tank flows down through pipe W into N, and thence into top of boiler and out through P, thence up pipe S and through to room D', shown in Fig. I, and up recess in wall to third floor, with branches to supply cold water for toilet basins and sinks on first, second, and third floors. A pipe branches from S at S', thence running up recess E to fourth floor and utilized as a circulating-pipe. This branch is **\forall of an



· THE SLOANE MATERNITY HOSPITAL · N.Y.

inch in diameter. The pipe N' branches from N over kitchen-sink and runs up recess F, as shown in Figs. 1 and 7, furnishing cold supply for slop-sinks on first and second floors. Another pipe branches from N at W', and thence extends up recess E, supplying cold water for water-closets, bath-tubs, and sinks on first, second, and third floors and bath in attic.

The hot supply from high-pressure boiler flows up into pipe P, thence to room D', and up recess, supplying hot water for toilet basins and sinks on first, second, and third floors. A branch leaves P at P' over kitchen-sink, passing up recess F, supplying hot water for sinks on first and second floors. The pipe branching from P at P' in dining-room hall is half an inch in diameter and runs up recess E, supplying hot water for baths and sinks on first, second, and third floors, and bath in attic.

The check-valve is set in the pipe N on opposite side of bend. The pipe T is connected with pipes G, N, P, M, R, and S, by means of 1/4-inch branches, in which are set small hand-cocks, that can be utilized for draining water from pipes whenever required.

The pipes U and U' are safe-wastes, which discharge into kitchen-sink through orifices, which are closed when not in use by flap-valves, as shown in Fig. 8. This device is made of brass of any size desired, to correspond with diameter of waste-pipes, and screwed into back plate of sink, the waste-pipe being connected with it in the rear. The flap-valve closes the opening whenever waste water is not running through it, and prevents smells from kitchen ascending through it.

Figure 9 shows the method of supporting porcelain slop-sinks. These sinks are located on first, second, and third floors, and are elevated about 18 inches above floor, and set 12 inches from wall, the dimensions of each being 16x26 inches. Galvanized-iron pipes, about one inch in diameter, are utilized for supporting these sinks. The pipes are secured to floor, and fastened firmly into wall by means of lead filling.

The master plumber who executed this work was Mr. John Toumey, whose foreman in immediate charge of the work was Mr. John Dorman, the architect being Mr. W. Wheeler Smith, all of New York City.

TREE ROOTS IN SEWERS.

OUR Milwaukee correspondent writes that "a year ago the plumbers were kept busy removing fish from supplypipes, but this year no complaints have been heard of that kind. Besides the case reported in our issue of November 26, the same plumber found at a house corner Oakland and Cambridge Avenues in that city a willow tree which had been planted directly over the sever and had forced its roots in between the joints of the pipe, completely choking it. The sewers were laid some years ago, before the present system of sewer inspection was in force. Under the new rules it would be difficult for tree roots to get into a sewer, as the joints have to be well cemented."

MASTER PLUMBERS' ASSOCIATION OF THE CITY OF PHILADELPHIA.

The regular stated and annual meeting of the Association was held on the 12th inst. for general business and election of officers for the year 1888. A prominent feature of the evening also was an official visit by the members of the Executive Committee of the National Association of Master Plumbers of the United States, who had been in business session in the city during the day. The visiting members were Messrs. Byrnes, President; Trainer, Vice-President; Recording Secretary Gabay, Colonel Scott, Treasurer Lyons, and Hannan, of Washington.

The result of the election is as follows:

President, William M. Wright.

Vice Presidents, Albert M. Hicks, John J. Weaver, Henry McDowell, William S. Clark, Samuel W. Barnes.

Recording Secretary, Enoch Remick.

Corresponding Secretary, William S. Clark.

Treasurer, William Harkness, Jr. Sergeant-at-Arms, Samuel B. Fleming.

Board of Directors: William M. Wright, President; John E. Eyanson, John J. Weaver, Albert M. Hicks Enoch Remick, Secretary.

THE "Great Eastern" has been purchased by a firm of Glasgow metal brokers, with a view to breaking her up. It is estimated that the cost of breaking up will be from £10,000 to £15,000. It is stated that there are some 10,000 tons of iron plates in the vessel, apart from other materials.



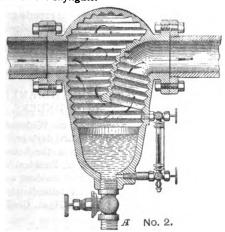
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

HINE'S GREASE ELIMINATOR.

STEAM in passing through an engine takes up more or less of the oil used in lubricating the valve and piston.

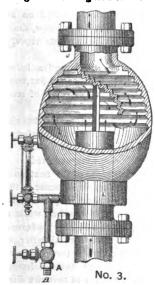
If this steam is condensed in an exhaust heating-system or otherwise, and returned to the boiler, the oil is apt to cause foaming and other troubles, and if exhausted on the roof it fouls the skylights.



As it is, the mixed oil and water are usually thrown away, while if separated they would each be valuable, for the use of the condensed water would save water bills and reduce scale in the boilers, while the oil could be used over again.

Such separation is the object of the device herewith illustrated.

Its operation is thus described by the inventor: "The exhaust steam upon entering the eliminator instantly expands, and, impinging on the corrugated and otherwise roughened surfaces, breaks up; the entrained oil, grease, and dirty water being expelled, adhere to the inner roughened surfaces, and gravitate to the bottom of receivingchamber and are discharged through the drain-valve "A," (which should always be left sufficiently open to allow a free passage of the oil and dirty water), while the clean dry steam, deflecting from the face of the depending partition is driven first down then upward in continuous contact with the roughened corrugated surfaces in its course.



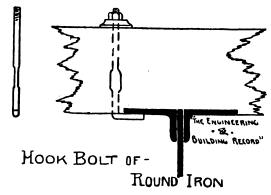
By extending a pipe from valve "A" into a sub-receiver, such as a barrel or tank, it will be found that the oil thus deposited is in no way impaired and can be used over again, care being taken to keep dirt out of the tank. As considerable water from condensation is discharged with the oil, passing together into the receiving-tank, the oil being the lighter will float, and can be skimmed or drained off, effecting thereby a saving of the cylinder oil, while grit or dirt being heavier than the water will sink to the bottom and be carried of when draining the receiving-tank."

The eliminator is the invention of Mr. F. A. Hine, and is for sale by lline & Robertson, 45 Cortlandt Street, New York City. Figures 2 and 3 show it as applied respectively to horizontal and to vertical exhaust-pipes.

A SIMPLER HOOK-BOLT.

PITTSBURG, PA., January 6, 1888.

SIR: In connection with your article on hook-bolts, which appeared in your issue of December 31, 1887, I would like to call your attention to the bolt which has lately been used quite extensively by the Keystone Bridge Company.



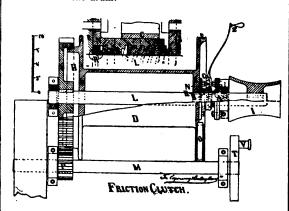
It consists simply of a piece of round iron bent and flattened at the lower end to suit the slope of flange and flattened again on the vertical portion so that when driven into a round hole it is wedged tightly enough to prevent turning under all ordinary circumstances. It is comparatively cheap to manufacture and experience has shown it FRANK C. OSBORNE. equal to its requirements.

IMPROVED FRICTION CLUTCH.

THIS clutch, designed by George E. Worthen and manufactured by Rawson & Morrison, Cambridgeport, Mass., is especially adapted for hoisting-engines, and intended to secure quickness, ease, and certainty of action with simplicity of construction. V is the crank-pin on disk T, keyed on main shaft M, which drives the drum-shaft L through pinion and gear P and S. A is a sleeve threaded on its exterior surface and bolted to flange of journal-box J. B is another sleeve or nut screwing on to A. A groove at one end engages the lip of flange N, which is made in two pieces and bolted to head E of drum D. N fits loosely on B and is recessed out to receive rings R of hardened steel. Clamp C is made in balves and bolted together so as to be adjustable to any required position on B.

The inside of rim of gear S is tapered and the flange H of drum-head is correspondingly coned.

The shaft L and winch-head I are always driven when engine is running, but the drum does not turn unless thrown into gear by moving lever Z. This unscrews B from A and thrusts the drum endwise against gear-wheel S, until the cone H engages the taper rim of S with friction sufficient to turn the drum.



The reaction of A and the longitudinal motion of L is resisted by a thrust bearing of grooves and collars at I.

Reversing the lever withdraws the drum and destroys

A large number of hoisting-engines are being fitted with these clutches, which are claimed never to stick or jam and to give perfect satisfaction.

The arrangement does away with a repelling spring and permits the drum-shaft to be of uniform size throughout. It also allows the winch-head, clutch-lever, and brake O to be on the side next to the engine and so near the usual position of the throttle-valve, and thus enables one man to control the engine, operate the clutch and friction brake, and tail the hoist-rope from the winch-head.

Winch-heads can be placed on both ends of the drumshaft if desired.

Correspondence.

All correspondents should s-nd us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

DISCUSSION ON STONEWARE VERSUS CEMENT SEWER-PIPE.

Office of City Engineer, DENVER, COL, January 6, 1888.

SIR: Can you cite files or pamphlets containing the discussion that appeared in print a few years ago Stoneware vs. Cement Pipe in Sewerage?"

H. C. LOWRIE.

[We do not remember any discussion on this subject. except an occasional spurt on the part of the manufacturers of either article. The fact is that good pipe can be made both ways, if none but the best materials and best methods are employed. But as it is much more difficult to judge of the quality of cement pipe after it is made than of stoneware, the former is generally regarded with suspicion. We should not recommend any city to use the cement pipe unless they had it made under their own supervision from materials of their own providing, using the best-known methods. It will not bear handling at once after making. Time is required to harden it.]

WHO BUILDS ICE-MAKING MACHINERY?

Office of the Board of Trade, ASBURY PARK, N. J., January 13, 1888.

SIR: Will you kindly inform me where the machinery or plant for the manufacture of i.e can be had, such as they use in Florida and other Southern States?

Respectfully yours, E. G. HARRISON.

[Referred to our readers.]

THE TREATMENT OF CONCRETE FOUNDA-TIONS IN STREET OPENINGS.

SIR: It seems impossible in a city like New York, which is continually demanding new appliances for comfort or dispatch, as well as repair of the old ones, to keep the street pavements, even when laid with care, from being continually taken up. And the only thing to be done in the premises seems to be to so arrange the method employed that the minimum amount of damage to the pavement and obstruction to the traffic of the street will be occasioned.

The method practiced by Mr. Deacon when City Engineer of Liverpool, as he once explained it to me, seems well adapted to the end in view. His plan was to remove the paving stones, and then, with straight, short picks, to cut two narrow channels through the concrete parallel to the sides of the intended ditch and then make narrow cross-cuts so that the concrete can be pried out in large slabs and laid on the pavement by the side of the ditch. The slabs should be cut about two feet wider than the ditch. After the ditch is back-filled the solid earth by the side of the ditch and under the undisturbed concrete is excavated to the depth of about eight inches and replaced by strong and very dry concrete; concrete should also be placed across the ditch to correspond in position with the cross-cuts made in the concrete. The slabs are replaced on these and the voids left by cutting the channels calked with rich mortar containing the least amount of water that will allow it to cohere under ramming. It will readily appear that the channels cut should be as narrow as possible.

In a few hours the pavement can be replaced and the traffic turned over it without fear of damage. Of course, the success of this plan depends on honest and thorough ramming, with intelligent supervision; though probably nothing would be done that would prove more unsatisfactory and wasteful than the present method of first breaking up the concrete into small pieces and then putting the fragments, which are not thrown in with the back-filling, under the pavement nominally to be used for fresh concrete after the poorly rammed ditch has settled.

EDWARD P. NORTH.

FANS SUGGESTED TO ASSIST SEWER VEN-TILATION.

PHILADELPHIA, December 29, 1887.

SIR: I observe in your issue of 17th inst. an article on sewer ventilation. Small connections with chimneys and flues, depending on natural ventilation, would, in my opinion, prove very inefficient in amount and very irregular and uncertain in working.

Digitized by GOGIC

It seems to me a good way to aerate underground sewers would be to locate an exhaust fan near a main sewer, drawing the air from the sewer and discharging it through a pipe or shaft above the neighboring houses where it would so quickly dilute as to be harmless. A fan with a capacity of 50,000 cubic feet per minute is not seriously expensive to build or maintain in running.

It might be attached to a main sewer of not less than ten feet diameter, taking care to trap the outlet if within a mile or two of the tan. so as to draw from the whole system rather than from the outlet. Taking a 5-foot sewer as above the average, the area is approximately four square feet, of which 12,500 feet when the sewers were empty would represent one minute's work of the fan, omitting allowance for friction of the air and for failure of fan to reach its imputed work.

In other words, two miles of average sewers could be aerated every minute, or a change of air once in five minutes of ten miles, or once in ten minutes of twenty miles of sewerage, could be effected by one fan, and the openings into the sewers, instead of being made for the egress of foul air, would be for the ingress of fresh air for aeration. The entire xtent which a single fan could aerate would, of course, depend on the grade and position of the sewers; the water-line must always be below the crown of the sewers to allow the sewer to be a part of the system. This, however, would fall within the care of the engineer in locating the fans and proportioning their size to the amount of communicating sewers for each district.

M. O. T.

[Fan ventilation for sewers has been tried and found wanting. It does seem at first glance as if it ought to accomplish the purpose, but it is found in practice that the friction of the air through long and more or less obstructed passages restricts the useful effect of the fan to very short distances, so that while a small hurricane may be drawing through the sewers near the fan those more remote are very little affected. Of course, a greater number of smaller fans would overcome this difficulty, but the complication and expense of such a plan preclude its consideration. Our correspondent's calculations would seem to imply that air is to be admitted only at the periphery of the system to be ventilated, and it is just because this cannot be done in practice that his scheme would fail. Even if it were possible to have no openings except at the points furthest removed from the fan, the difficulty of so proportioning them to the draught and friction in each case that the ventilation of connecting sewers should be anything like uniform would be an insurmountable obstacle.]

CAR-HEATING FROM LOCOMOTIVE ON THE CHICAGO, MILWAUKEE, AND ST. PAUL RAILROAD.

"The experiment of heating trains by steam has been successfully tested by only one Western line—the Chicago, Milwaukee, and St. Paul Railway—and now the through trains of that company leaving Chicago every day at 7:30 P. M., and leaving Minneapolis at 6:50 P. M., and St. Paul at 7:30 P. M., are systematically equipped with steamheating apparatus.

"No matter what degree of cold may exist anywhere along the line, an even temperature of heat is maintained throughout the interior of the train.

"As rapidly as possible all through trains on the various other lines of the Chicago, Milwaukee, and St. Paul Railway will be provided with appliances for the heating of its coaches by steam."

On reading the above from a recent issue of the Minneapolis *Tribune*, we wrote Mr. D. J. Whittemore, Chief Engineer of the Chicago, Milwaukee, and St. Paul Railroad Company regarding it, and have received in reply the following interesting communication from Mr. George Gibbs, their Mechanical Engineer:

CHICAGO, MILWAUKEE, AND ST. PAUL R. R. CO., MECHANICAL ENGINEER'S OFFICE, MILWAUKEE, January 3, 1888.

S1R: Yours of the 23d to Mr. D. J. Whittemore has been referred to me. I shall be most happy to give you the desired information as far as is in my power to do so. We have gone into the subject of safety car heating quite extensively in an experimental way in order to determine the best and most practical plan for a climate of extremes, such as we meet with in the North-west.

After examining the various schemes offered by inventors and the systems at present in use, we concluded that the most promising field lay in the use of steam direct from the locomotive Equipping a train last spring in this way with the Martin system, enabled us to try, in mild weather only, its reliability, and the steam consumption within a limited range of outside temperatures. These figures, which have already been published, demonstrated that for zero weather a mininum of 100 pounds of steam at about ten pounds pressure were required for each car per hour. This, you will notice, was far

above the estimates given by inventors and others; and although the loss to a locomotive might thus at times prove serious, we did not believe it actually prohibited further experiments.

The question of an iron car to be attached to each train, and to contain the heating arrangements, naturally arose, but from the acove computation it is evident that the drain from heating direct is less than that entailed by haulage of the additional car.

Starting from this as a basis, and from our experience with the Martin train, we have devised a system of our own with which to continue the experiments extensively this winter.

We have now equipped twenty-three cars and eighteen engines, and are heating our two through Chicago Minneapolis express trains regularly. Next week we expect to have a local train of six cars running in Minnesota.

I send herewith a blue print showing our method of platform connections and one of the automatic hose-coupling. The coupling belongs to that class in which the two portions are dissimilar, the male being attached to the hose and the female fixed on the platform. The construction will be obvious from the drawing. The female part consists of a hollow casing adapted to receive a thin flexible diaphragm carrying a metallic annulus in centre, which forms one bearing surface of the joint. This annulus is secured around hole in diaphragm by bending over the metal, thus allowing free expansive movement of diaphragm without danger of joint becoming loose. The diaphragm is held in place by a threaded ring carrying two projecting wings, which form the clamping device, with two similar wings on the male portion. The bearing of these wings are similar warped surfaces, the purpose of which is to form a lock when coupling is together. The coupling is effected in a vertical plane, parallel to that through axis of cars by placing the gasket of male portion on that of female and rotating ninety degrees, which brings the wings into contact. The purpose of the diaphragm is to insure an absolutely steam-tight joint, it being forced outward, when under steam, by the unbalanced pressure behind, tightly against gasket of male portion. It may be noted that in this diaphragm contact coupling the use of a soft gasket is avoided. Two soft metal surfaces make a perfectly tight joint, but we use one metal face and hardest grade of vulcabeston gasket in male coupling. Referring to diagram of platform: the couplings are connected across back of end sill; at points of junction with main train pipe a three-way cock is placed, allowing steam passage to either coupling or cutting off both. One line of hose only is used at a time, the other being kept in reserve in a "dummy coupling," ready for immediate use in case of accident.

The couplings are made the highest point in the system, the train pipe having a continual slope from them to centre of car. This point I consider is of advantage, making it unnecessary for the hose ever to be parted, and making freezing at the most vital point, through carelessness of trainmen, impossible. We found in case the couplings formed a pocket, as with most of the couplings on the market, that great care had to be taken not to let the locomotive be disconnected any great length of time at division points when changing on account of water lodging there and freezing rapidly through cold metallic surfaces. This matter of changing engines properly is, as may be imagined, difficult to regulate at times. The experimental stage can hardly be said to have passed yet, as we have had but little very cold weather and have several plans of piping on trial. The one insuring undoubtedly the most comfort to passengers, but entailing somewhat greater complication in piping, is that in which we combine ventilation with heating. In this we add to heating along trussplanks a compact radiator in each end of car. These are boxed in and have registers top and side. Near the flow on one side a connection is made directly with the hot air injection-pipe of our Spear heater. The motion of the train thus forces fresh air around radiator and out of top register. If car becomes too cold the injector is shut off, and the stack then acts as ordinary radiator by opening both registers. Suitable valves have been arranged to permit shutting off either side pipes or radiators, or both, as occasion requires.

I have no doubt of the ultimate success of some plan of heating by steam from the locomotive, but it would be rash to say that we have arrived at this stage yet; in fact, from our own experience, I know that no system in use now extensively will be a success in an extremely cold

climate without many changes. Too small pipes and projecting valves and nipples are absolutely certain to give trouble. Systems well devised for house use are not adapted for cars in winter. An increase of not less than fifty per cent. in pipe areas should be allowed to insure perfect circulation. We are trying two systems of automatic temperature regulation in two coaches. In these the inlet-valves are controlled and operated by regulating apparatus. In one system, the Johnson, a battery of three Leclanché cells in connection with a thermostat operates an electric-valve which admits air from the auxiliary reser. voir of the Westinghouse brake to the diaphragm valves to shut off, and open the same and control admission of steam to the piping. In three weeks of constant service no new defects have developed in the regulation and the coach has not varied 4 (four) degrees at any time when in service. We shall at some future time be glad to give you further particulars of the success of our experiments, if cl interest to you, and when the best plan for adoption has been determined will be glad to send you particulars. Trusting the above will be satisfactory, I am,

Very truly yours, GEORGE GIBBS, Mech. Eng.

THE ANNUAL MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE annual meeting was held on Wednesday and Thursday, January 18 and 19. The first day's proceedings were opened by a business session at the house of the society, commencing at 10:30 o'clock, President Worthen in the chair, and a large number of resident and other members present. The polls were immediately opened for balloting for officers, and Messrs. Hunt, Gosling, and Haviland appointed tellers.

The annual reports of regular and special committees were then presented. First, that of the Board of Direction, stating that during the last year 116 members had been added to the roll, 11 of which were transfers from the junior and associate grades; 11 members had been removed by death and a few by resignation, leaving a present total membership of 1,110, greater by 91 than at the commencement of the year. The details of membership, etc., were presented, together with general minutes of the annual convention and the year's progress; 19 meetings of the society having been held in all, inclusive of convention, and 14 meetings of Board of Directors.

The Committee on Technical Training reported their recommendations that investigations, publications, and expenditures should, for the present at least, be directed in lines of interest to experienced engineers capable of criticising the solutions of practical problems, and that the advisability of primary education might be considered by the society if warranted by future ability.

The Library Committee reported an addition of 526 books and pamphlets, and 131 maps, drawings, etc., and presented detailed list of various reports received from committees and others.

The Treasurer's report showed a balance on hand of \$8,659.13, after having expended \$22,299.68 for various purposes, and stated the particulars of receipts, expenses, and investments.

The Finance Committee reported that all bills paids had been carefully audited and found satisfactory and properly charged to the respective funds.

All the above reports were accepted.

The subject of the place of the next annual convention was then introduced, and in response to the circular which had been issued to members requesting suggestions, 105 replies were in favor of Milwaukee, while a score or more of places in the East and South were favored by one to five members each. A very cordial letter of invitation to Milwaukee from 15 members there resident and the Mayor of the city was read, and another letter recording the enticing mean temperature of that city during the months of June and July for several years past was put inevidence. It was moved and carried that the next summer convention be held in Milwaukee at a date to be fixed by the Board of Direction.

The Committee on Uniform Standard Time reported steady progress in that reform movement.

A pamphlet had been prepared presenting and explaining the matter and furnishing complete information. This, with a list of questions, has been sent to the officials of the most important railroads. To the question, "Do you approve of the 24-hour system?" 61 replied in the affirmative and 38 in the negative; 76 were, and 21 were not, willing to adopt it in their train-service if connecting



branches would do the same. Many thought the system would be readily adopted by local residents and that it was a practicable measure. The system is now in use on the C. P. R. R. from Quebec to Manitoba and by several other roads and is to be adopted by others. It is highly commended in numerous letters from railroad officials and employees. The report was accepted and the committee continued.

The Committee on Joint Library stated, that while they believed such an arrangement with other societies should be consummated, they had been unable to make any satisfactory progress in that direction. The report was accepted and committee discharged.

The Committee on Rails and Wheels had been unable to complete preparation of report, and were continued and the filling of the vacancy made by absence of one member abroad was authorized.

Letters were read and followed by remarks from experienced members present, upon the definite employment and relative value of the titles resident, division, and assistant engineer. Much ambiguity was believed to result from the lack of uniform distinction, and a committee was appointed to investigate the matter and present recommendations.

The polls having been closed at 12 o'clock, the tellers announced the election of the following officers:

As President, Thomas C. Keefer; as Vice-Presidents, J. James R. Croes and Robert Moore; as Secretary and Librarian, John Bogart; as Treasurer, Georg: S. Greene, Jr.; as Directors, Mendes Cohen, Joseph M. Wilson, Stevenson Towle, Charles B. Brush and Alphonse Fteley.

Proposed amendments to the constitution were then introduced, and also amendments to the amendments. These had previously been presented in a circular from the secretary to members, and the main features were the raising of the qualifications for membership, the creation of a student grade, change of title of present junior grade, and some changes in the rules for election of members, and

in the by-laws. The points were of very general interest and elicited warm discussion, which was suspended at 13:30 o'clock by an intermission, while a collation was served in the society's rooms to members and guests present.

The meeting was called to order at 15 o'clock and briefly addressed by President-elect Keefer, and the discussion of amendments became general and animated, chiefly centering on the clause proposing a student grade. Letters were read for and against it, and a member of the British Institute of Civil Engineers explained at length the working of the system in that society. Some members believed that such a grade in this society would benefit both parties; others, that it would harm both; others, that it would be immaterial and practically inoperative; others, that it would lower the dignity and reputation of the society and lead to ambiguity and dissatisfaction; and others thought that all reasonable advantages might be extended and are now accessible to technical students without their having any connection with the society.

Resolutions were finally passed commending the first and last amendments and disapproving the others—viz., those relating to the proposed student grade, and to changing the name of the junior grade, and a committee was appointed to suitably prepare the proposed amendments for presentation to the society for letter ballot.

The Committee on Cements stated that the preparation of a considerable portion of the matter was delayed, and presented a brief report, which was accepted and committee continued.

A committee was appointed to arrange and recommend standard rain gauge observations.

The awards of Norman Medal and Rowland Prize were deferred, owing to absence of some members of the committee.

The meeting was then adjourned until evening.

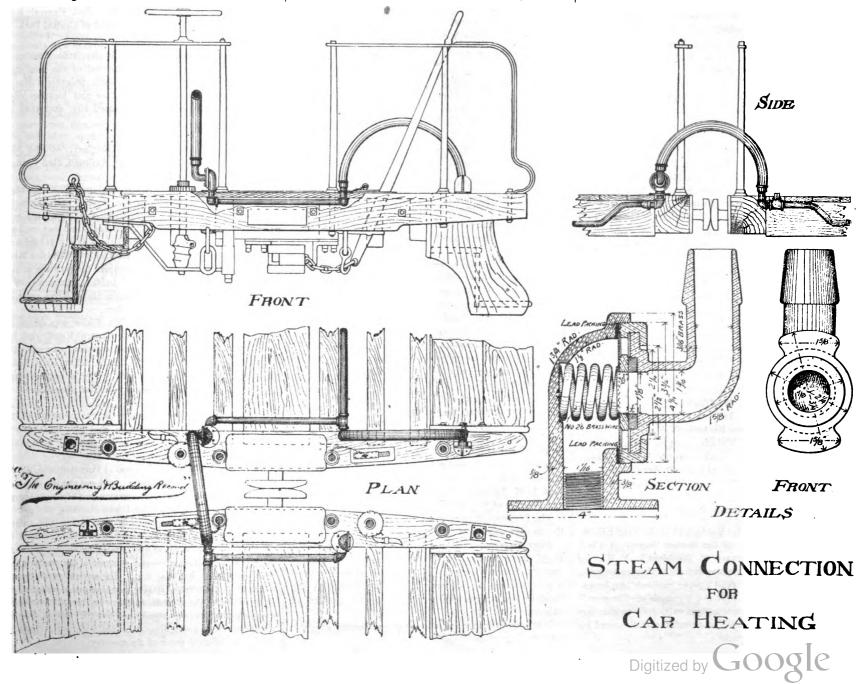
At 20 o'clock a full attendance of members, guests, and ladies were called to order in the hall of the Young Men's

Christian Association, near the society house, and Lieut. C. C. Rogers, U. S. N., was introduced by the chairman Mr. William G. Hamilton. Lieutenant Rogers was detailed by the United States Government to report on the condition of the Panama Canal, and, arriving at Aspinwall last May, remained for several weeks a guest of M. De Lesseps, accompanied him in his inspection survey, and was afforded every courtesy and facility for investigation by the company's engineers and officials.

This paper, of which a full abstract will be given in a future issue, was the record of these observations and investigations. It was illustrated by maps, profiles, and tables, and comprised a general description of the canal proposed, located and under construction, the nature of the country, conditions of work and attendant obstacles; stated the classification and division of work under contract, and approximate amount finished and required; outlined the methods and enumerated the principal items of working plant, cost of finished construction and future work; described the hospitals, offices, etc., and summarized the weight of evidence as indicating that the completion of the canal was only a question of time and money, about one-third of the work having been already done. A large number of interesting stereopticon views were shown, illustrating progress of work, principal machinery, houses, offices, landscapes, etc.

A vote of thanks was tendered to Lieutenant Rogers, and meeting adjourned until 9:30 the following morning, when the members met at the house of the society for an excursion to the new Harlem bridge.

The members met at the house of the society at 9:30 o'clock the next morning, and proceeding to the foot of West Twenty-first Street, embarked on the steamer chartered for the occasion, and were landed an hour later at High Bridge, Mr. Watts Cooke, President of the Passaic Bridge Company, and Mr. Myles Tierney, contractors for the new Harlem Bridge, received them, and, together with Engineers Hutton, Cooper, Bogart, Leers, and Brush and



heir corps of assistants, conducted them about the scene of so much interesting construction, which, though it spoke most effectively for itself in its magnitude and simplicity of detail, was more quickly and readily followed by their brief outline of methods and conditions, and the practical illustrations afforded by the working of nearly all the varied and extensive mechanical plant.

The wide platforms and stairways made the inspection of this work (description and sketches of which we publish this week) unusually easy. Returning to the steamer, a lunch was served and very interesting sets of photographs of the work just inspected were presented by the contractors to the members of the society, who so soon exhausted the supply that a second edition was promised.

In the evening a reception was held at the house of the society, the committee's report on constitutional amendments was received and accepted, and the annual meeting adjourned.

The remainder of a very pleasant evening was devoted to the lunch tables, conversation, and the proposal of toasts, responses, and speeches.

The following members and guests were among those present at the annual meeting:

William E. Worthen, Gen. George S. Greene, George S. Greene, Jr., William J. Haskins, Downing Vaux, Theodore Cooper, W. G. Hamilton, John Bogart, W. II. Paine, F. A. Calkins, C. C. Schneider, W. W. Maclay, W. Howard White, S. Willett Hoag, Jr., Joseph P. Davis, W. H. Wiley, A. W. Trotter, A. M. Wellington, A. P. Boller, Josiah Briggs, J. A. Bensel, J. J. R. Croes, J. P. Davis, C. E. Emery, J. F. Flagg, E. B. Gosling, J. R. Wardlaw, E. E. Magovern, H. W. York, J. W. Ferguson, C. E. Jackson, J. F. Lewis, W. A. Nichols, S. F. Morris, O. F. Nichols, E. P. Playle, J. F. Sorzano, J. G. Sanderson, F. W. Skinner, J. Thomson, E. B. Van Winkle, A. L. Webster, G. A. Just, S. B Downes, C. M. Harris, R. L. Harris, H. C. Meyer, William Gibson, Jr., Frank Waller, James Moylan, Frederick M. Kelley, George B. Cornell, T. D. Whistler, J. Hoehn, Jr., R. Hering, D. McN. Stauffer, F. R. Hutton, F. A. Lovecraft, A. P. Trautwine, Charles Hewitt, S. Stevens, B. S. Church, Frederick S. Cook, New York; G. Lindenthal, Pittsburg, Pa.; T. H. McKenzie, Southington, Conn.; F. W. Whitlock, Waterbury, Conn.; G. Leverich, A. G. Brinckerhoff, H. W. Brinckerhoff, Dickinson Macallister, Albert Lucius, Brooklyn; W. A. Smith, Brooklyn; E. E. R. Tratman, Brooklyn; E. S. Gould, Scranton, Pa.; P. Roberts, Jr., Philadelphia, Pa.; G. S. Rene, A. Fteley, E. P. Frost, H. Wemley, J. H. Stack, S. F. Olney, N. J. Belton; G. B. Nicholson, Cincinnati; C. Fischer, Trenton; M. Merriman, Bethlehem, Pa.; R. Moore, St. Louis, Mo.; J. Owen, Newark; A. B. Paine, Poughkeepsie; W. H. Baker, Fitchburg, Mass.; G. B. Francis, Providence, R. I.; E. Blorston, Providence, R. I.; G. C. Tingley, Providence, R. I.; W. Stow, Providence, R. I.; T. F. Brendlinger, Pottsville, Pa.; II. F. Bonney, Montreal; C. E. Goad, Montreal; T. A. Peterson, Montreal; J. W. Bacon, Danbury, Conn.; W. F. Booth, Poughkeepsie, N. Y.; A. F. Noyes, West Newton, Mass.; A. Pou, Talbotton, Ga.; R. J. Pratt, Albany, N. Y.; P. C. Rickett, Troy, N. Y.; B. Reece, Toledo, O.; W. A. Sweet, Syracuse; O. T. Whitford, Syracuse; G. W. Shaw, Louisville, Ky.; J. P. Snow, Woonsocket, R. I.; D. J. Whittemore, Milwaukee, Wis.; A. M. Connett, South Orange, N. J.: Robert Cartwright, Rochester, N. Y.; J. I. Fanning, Minneapelis, Minn.; D. Fitzgerald, Brookline, Mass.; W. L. Goodrich, Leominster, Mass.; H. H. Gladding, New Haven; A. B. Hill, New Haven; W. M. Hughes, Cleveland, O.: A. Haviland, San Antonio, Tex.; S. S. Haight, West Farms. N. Y.; C. W. Hunt, New Rochelle, N. Y.; E. W. Howe, Boston, Mass.; F. O. Whitney, Boston, Mass.; T. C. Keefer, Ottawa; A. W. Locke, North Adams, Mass.; W. H. Burr. Phœnixville, Pa.; Charles B. Brush, Hoboken, N. J.; F. Collingwood. Elizabeth, N. J.; Mendes Cohen, Baltimore; D. D. Clarke, Tacoma, W. T.; E. L. Corthell, Chicago; J. J. Schaefer, Newark, N. J.

THE BOSTON SOCIETY OF CIVIL ENGINEERS.
The monthly meeting of the Boston Society of Civil Engineers was held January 18, President L. F. Rice in the chair, thirty-one members and eight visitors present. Mr. Jerome Sondericker read a paper entitled "An Investigation as to How to Test the Strength of Cements," showing portions of apparatus used in experiments at the Institute of Technology. The question was discussed by several members of the society.

THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

THE eighth annual meeting of the Engineers' Society of Western Pennsylvania was held at Pittsburg on January 17, 1888. The Treasurer reported total receipts, \$1,469.50, and total disbursements \$1,614.12; leaving a balance of \$161.69.

The Secretary reported that there were admitted during the year 1887, 39 members, and that the society had lost from various causes 13 members, leaving a total membership of 330—a net increase of 26 over last year. During the year ten regular meetings were held.

Mr. Alexander Dempster, the retiring President, read an address containing a résumé of the work of the society during the past year and urging active work for the coming year, after which the society elected the following officers: As President, Alexander Dempster; as Vice-President, two years, W. L. Scaife; as Directors, two years, T. P. Roberts, Charles Davis; as Treasurer, A. E. Frost; as Secretary, S. M. Wickersham.

This concluded the business of the annual meeting. In the regular monthly meeting ten new members were added. A paper was read by Mr. Thomas J. Bray on "The Manufacture of Welded-Steel Tubing," of which an abstract with the discussion will be given in a later issue.

THE NATIONAL ASSOCIATION OF MARINE ENGINEERS.

THE National Association of Marine Engineers met at Milwaukee, January 9, 1888. Among other business the resolution touching on too little help in the engine-room of lake steamers was amended to include ocean steamers, and was referred to the Committee on Legislation, who will bring the matter before the Board of Marine Underwriters. A committee of three, consisting of National Secretary Harris, National Treasurer Galway, and Representative Uhler, was appointed to revise the constitution, and the following resolution was adopted:

"Resolved, That the greetings of the National Association be and are hereby extended to the National American Shipping and Industrial League, soon to hold its annual session in Washington, and that it is the sense of the National Association that some measure is needed to foster and encourage increased shipping facilities, not only upon the high seas, but upon inland rivers and lakes. Our rivers and harbors need improvements, our seagoing shipping needs that protection that will enable American ships to compete with alien tonnage."

The committee representing the resolution was James H. Harris, of St. Louis, Joseph I. Kroch, of Milwaukee, and Andrew Gaul, of New York.

The association adjourned on the 13th inst. to meet in Baltimore on the second Tuesday of January, 1889.

ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting of the club was held in the club room January 9, 1888. There were twenty members and five visitors present. The minutes of the annual meeting and of the meeting of the Executive Committee were read and approved.

The following officers were elected for 1888: President William B. Knight; Vice President, Octave Chanute; Directors, T. F. Wynne and William H. Breithaupt; Secretary, Treasurer, and Librarian, Kenneth Allen.

Mr. Frederick B. Tuttle was elected a member. It was voted to ballot for the following amendment to Section 2 of the By-Laws: In place of "The annual dues shall be eight dollars (\$8) for members and seven dollars (\$7) for associate members and associates" for the word "seven" substitute "five."

The resignation of the Treasurer, to take effect at the next regular meeting, was accepted.

The Secretary read a communication to the Committee on National Public Works from Mr. John Eisenmann, Secretary of the Council, and presented for Mr. W. D. Jenkins a handsome framed photograph of the C. M. & St. P. Railway bridge over the Missouri at Randolph, and for Prof. J. M. Johnson, of St. Louis, a copy of his "Theory and Practice of Surveying."

The President then read his annual address, after which the meeting adjourned.

After the meeting the club repaired to the Brunswick Hotel, where an excellent supper was served to 22 members and four invited guests. That the affair was thoroughly enjoyed by all present may be inferred by the difficulty encountered in passing numerous motions to adjourn.

It is hoped that the annual supper may become a regular feature of the club.

THE NIAGARA CANAL PROJECT.

PRESS dispatches state that the old plan to build a canal around Niagara Falls has been revived by a bill introduced in Congress by Representative N. W. Nutting, of the Oswego district, "to create navigable ways between Lake Erie and Lake Ontario." This bill passed the House as far back as 1862 or 1863, but failed then to become a law. The canal, according to surveys which have been made, will only be six miles ln length, and will not cost more than eleven or twelve million dollars. The value of the canal as a water-power would, it is expected, pay for its cost in a very short time.

PERSONAL.

ARCHITECT G. B. FERRY, of Milwaukee, is dangerously ill.

ARCHITECT E. T. MIX, of Milwaukee, who has been suffering from congestion of the lungs, will spend the winter in Mexico.

EDMUND M. WHEELWRIGHT and Parkman B. Haven, architects, of Boston, have become associated, their office being 6 Beacon Street.

DR. JOHN S. BILLINGS, LL.D. (Edinb.), Surgeon, U. S. A., is to deliver a course of lectures before the Lowell Lecture Association of Boston.

MR. J. F. O'ROURKE, M. Am. Soc. C. E., left this week for Laredo, Tex., to take charge of placing foundation for new bridge of the Mexican National Railroad crossing the Rio Grande River, to be built by the Union Bridge Co.

MR. BENJAMIN F. CRANE, civil engineer, died in this city this week at the age of 71. He was born in Saratoga County and was connected in a professional way with the Croton Aqueduct, Erie Canal, New York Central Railroad, and was the first superintendent of Central Park.

G. W. McNulty, C. E., of this city, still remains at Niagara Falls prosecuting the renewal of the long-span Suspension Bridge there. The work progresses despite the severe conditions of temperature and location (completely enveloped by spray-saturated air), and they are about ready to set anchor-bars.

CHARLES H. FISHER, Chief Engineer of the New York Central and Hudson River Railroad, died January 18, in New York City.

The deceased was born in Lansingburg, N. Y., in 1835. His initiative labors were on the Racine and Janesville Railroad in Wisconsin, and later he was connected with the State Engineer's staff of New York, and was engaged in the work of constructing the Erie Canal. He entered the employ of the New York Central and Hudson River Road in 1860, and in 1868 he occupied the position of first assistant engineer, but resigned to take the position of chief engineer of the Lake Ontario Shore Road running from Oswego to Suspension Bridge.

On the 1st of January, 1869, Mr. Fisher was appointed chief engineer of the New York Central Road, and had charge of all the engineering work on that road until two years ago, when he was compelled to retire from active work on account of failing health. The deceased was a member of the American Society of Civil Engineers.

RICHARD EDWARD EMERSON BUTTFRWORTH, C. E., of Grand Rapids, Mich., died in that city on the 17th inst., from the effects of a stroke of paralysis with which he was stricken a few days previous.

Mr. Emerson was born in 1806 at Port Antonio, Island of Jamaica, British West Indies, and was the son of a captain in the British Army and commandant of Fort George

He was educated in England, and choosing the profession of a civil engineer, placed himself under the tuition of William Nicholson, of Manchester. He recalled the construction in 1830 of the first locomotive engine—George Stephenson's "Rocket"—and was one of the party which rode upon it on its trial trip. For several years he was engaged at Manchester in the manufacture of cotton, but later settled in the United States. In 1875 he made the pumping-engines and machinery for the Grand Rapids water-works, and was also identified with similar under-

n different parts of the country.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

COLUMBIA, S. C.—At a recent meeting of the Commissioners for the completion of the State House, held in this city, the Secretary State House, held in this city, the Secretary of the Commission was directed to advertise the fact that on or before the 1st of February, the State House Commission will receive applications for the position of Resident Super-intendent Architect for carrying on the work on the State House, that such application must be accompanied by ample credentials both as to character and competency of the applicant. In accordance with the above resolution, all In accordance with the above resolution, all applications for the position of "Resident Superintendent" must be filed by the 1st day of February prox. J. S. Verner is Comptroller-General and Secretary of the Commission.

RICHMOND, VA.—Plans are wanted by the Masonic Temple Association, of this city, for Masonic Temple. The Association will a Masonic Temple. The Association will receive competitive plans from architects, and will pay the sum of \$3,000 for the plans adopted. A schedule of instructions to architects and any other information can be had by addressing the Treasurer of the Association, W. B. Isaacs, this city.

LANSING, MICH .- The Methodist Episcopal Society of this place wants plans for a church to cost \$25,000. For full information address B. F. Hall, Chairman Building Committee, this city.

ARCHITECTS have not yet been selected for new Y. M. C. A. buildings at Newark, N. J., Trenton, N. J., Bangor, Me., Wilkesbarre, Pa., and Canton, O. Also for an Odd Fel-lows' temple at Findlay, O.

WARRENSBURG, Mo.-Plans are wanted in this city for a court-house, to cost \$60,000, for Johnson County. Address the County Clerk at this place.

LINCOLN, NEB .- Plans are wanted at Lincoln. Neb., for a new court-house for Lancas-ter County, to cost \$200,000. The plans recently selected have been rejected, as bids submitted according to them exceeded the amount of the appropriation by \$50,000.

PLAINWELL, MICH.—Plans are wanted by the officials of Allegan County for a court-house, to cost from \$50,000 to \$75,000. A committee has been appointed to prepare a schedule of instructions to architects who may desire to submit plans in competition, who will report at the January meeting of the board. John Crispe, chairman of the board, Plainwell, Mich., will give any desired infor-



For works for which proposals are requested see also the "Proposal Column," pages i-iv-v-v11-v111-127.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and relable news for our "Contracting Intelligence." Information of importance sent to be exclusively, and not essewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

SALT LAKE CITY, UTAH.—Mr. Lowrie, C. E., of Denver, Col., is engaged in making an estimate of the probable cash expense of a system of sewerage for this city, and also of ascertaining the best method of laying the same. As soon as his report is submitted further steps will be taken by the city officials.

Los Angeles, Cal — The Vineland Water and Development Co. has been incorporated, with L. H. Washburn and others at its head. Capital stock, \$100.000.

NAUGATUCK. CONN.—Concerning report that a systen of water-works were to be established the cour correspondent writes as follows:

Only to open books for subscription to shares.

Think that they will be all taken by summer."

MIDDLETOWN, N. Y.— Carroll Phillips Bassett, C. E., of Newark, N. J., is planning an improved sewerage system for this place.

READING, PA.—Concerning the report that this city was to issue bonds in the sum of \$300,000 to improve its water-works system, our correspondent writes as follows: "At this time nothing has been done except to present a report upon the necessity of having an additional supply, to councils, and a resolution to authorize a vote of the people upon the ques-tion of increasing the indebtedness of the city \$300,000, or as much as is necessary, for the \$300,000, or as much as is necessary, for the purpose of increasing the city water-surply. The resolution has passed Select Branch on the 9th inst., but has not yet been reached in Common Branch."

NEVADA CITY, CAL.—Concerning the report that the water works here were to be improved, our correspondent writes: "No steps have yet been taken toward the improvement of the city water-works. Some time ago it was proposed to increase the storage capacity by enlarging the reservoirs and to put in larger mains, but nothing has been done as yet. The water-works that supply this city are owned by a private corporation." a private corporation.

CANON CITY, Col.—Our correspondent writes: "The State is making preparation to put in water-works for the prison, but has not made any contracts yet, only to obtain lumber. Will give any further information when I can."

KANSAS CITY, Mo,-Considerable money is to be expended in this city in extending the sewerage system. Contracts will be let during February.

LEAVENWORTH, KAN .- All the bids for the 700,000-gallon pumping-engine have been declared excessive, and the Leavenworth Water Company has decided to advertise for new ones, to be opened February 20.

FRANKFORT, MICH.—Concerning the election on the water-works question here, our correspondent writes, under date of January II, as follows: "Water-works carried by fifty majority yesterday. Great rejoicing to-day.

WALTHAM, MASS,-Concerning the projected sewerage system for this city, our cor-respondent writes as follows: "The subject of the diposition of our sewerage is being considered by a commission composed or our own citizens. The general plan of mains and laterals in the city is already practically adopted, and as soon as the method of disposal is determined will undoubtedly be commenced."

SIDNEY, O.--Our correspondent writes from this place as follows: "On the 3d of this month we voted for issuing \$60,000 additional water-works bonds to improve our water-supply and it was carried. We want a competent eng.neer to prepare plans, specifications, and estimates, and when all is ready will advertise and let. We think of putting in a new steam plant, double sets of machinery, tu be wells, and about four miles of new pipe and revise the old pipe."

OCALA, FLA. - Concerning water-works matters here, our correspondent writes as follows: "Contract and agreement made with Jeter & Boardman, of Brunswick, Ga., to put 1.1 works and supply city with 50 hydrants on streets for \$2,500 per year for 25 years."

JERSEY CITY, N. J.—Our correspondent, on inquiry concerning water-works matters here, writes as follows: "No steps are being taken at present to improve the water-supply.
Will inform you when any are taken."

JAMAICA, L. J.—The Jamaica Water-Supply Company, having just completed its plant in the above village, has made application to the Town Board for permission to lay pipes through this town and furnish water from flowing wells, under a pressure of 50 pounds to the square inch, or equal to 150 feet head. The application will be considered by the Board

BOWLING GREEN, O.—The water-works question, which has been agitated here for several months, was settled at the polls on the 16th inst., and the system is to be built at once. Messrs. Ferris & Holliday, of Jersey City, N. J., have received the contract and are already making arrangements to begin over the contract. already making arrangements to begin opera-

_____ BRIDGES.

AYLMER, CAN.—Concerning the published report that two new bridges were to be erected here, our correspondent writes as follows: "Both bridges have been built, one a Queen, the other a Howe truss; both wooden."

JEFFERSONVILLE, IND.— Concerning the reported erection of a bridge from this city to Louisville, Ky., our correspondent writes as follows: "This city, under the constitution of the State, can take no step in a pecuniary way to construct the bridge, its debt now be ing over the limit. We are waiting now for certain legislation in Kentucky before pushing the enterprise, which will be procured in a few weeks, the Legislature being now in session. There is no doubt in the minds of the incorporators about the speedy completion of the

SUFFIELD, CONN.-The Berlin Iron Bridge Co., of East Berlin, Conn., has been awarded the contract for building two iron bridges for this town. The prices are as follows: Stoney this town. The prices are as follows: Stoney Brook bridge, 75 feet, \$1,550; Oil Mill, 128 feet, \$2,050.

MILWAUKEE, WIS.—A bridge will be built across the North Menomonee Canal at Muskego Avenue that will cost \$40,000.

WESTFIELD, MASS.—Concerning the report that several bridges were to be erected at this place, our correspondent writes: "No steps taken as yet; the bridges will probably be built by the New Haven and Northampton Railroad Company, as they are the proper parties to do so, and information desired may be better obtained of them." be better obtained of them.

RAILROADS, CANALS, ETC.

WHEELING, W. VA.—It is reported that the Wheeling and Harrisonburg Railroad will build a line from this city to Bowerstown, O.; also that depots will be erected in this city. Ex-Senator J. M. Camden can furnish details.

RICHMOND, N. Y.—A street railway is to be built here. The Board of Trustees can give details.

PLATTSMOUTH, NEB.--The Plattsmouth Belt Line Company has incorporated, and will build a belt line around the city, to cost \$1,000,000. Nathan Shilton will give details.

QUINCY, MASS .- John Quincy Adams, of this city, and Arthur Burman, of Boston, Mass., are at the head of a project to build a street railway in this city.

NEBRASKA CITY, NEB —A street-railway is to be constructed here. S. H. H. Clark can give full details.

GAS AND ELECTRIC-LIGHTING.

THREE RIVERS, MICH.—An electric-light plant is wanted here. Address the Town

OCALA, FLA.—Our correspondent writes from here concerning gas-works: "Work going on; tower complete; well will be sunk soon and pipe laid."

WILLIAMSPORT, PA.—The Home Edison WILLIAMSPORT, PA.—I he Home Edison Electric Light Co. is erecting poles through-out the entire city for illuminating purposes to be paid for by individual subscription, pending the action of Councils.

MILWAUKEF, Wis.—The question of lighting the court-house with electricity instead of gas is attracting the attention of some of the hembers of the Board of Supervisors. Address Fred Wilkins, County Clerk.

PEABODY, MASS.—This place is to be lighted by electricity.

Owosso, Mich.-It is reported that an electric-light plant is to be established here.

POTTSTOWN, PA.—Herman Wells is reported to be at the head of a scheme to intro-duce an electric-light system in this place.

OURAY. Col. - An electric light plant is to be established here in the spring.

TROY, N. Y .- It is rumored that the gaslight company will substitute electricity for gas.

WARREN, R. I.—A movement is on foot here for electric lighting the town. Address Theodore Warren.

SEWARD, NER.-The Electric Light and Power Company, with a capital of \$10,000, has been incorporated, and will erect a plant. John Cattle is interested.

STREET WORK AND PAVING.

EAST SAGINAW, MICH. - John J. Granville, City Engineer at this place, writes us, under date of January 16, as follows: "Plans, profiles, and estimates for paving about three miles of streets with sapless cedar blocks have been prepared and submitted to the board for consideration. The total amount of paving will amount, in the aggregate, to 500,000 square yards. In addition to this 3,000 lineal feet of macadamized road has been ordered. Proposals for this work will probably be solicited in a week or two.

"This city has constructed during the past year 23.752 feet or 4½ miles of sewers, costing \$101.026.59. Of this amount 7.403 feet, or 1.4 miles, were 12, 15, and 18 inch pipe sewers, and 16.349 feet, or 3.1 miles, were brick sewers, ranging in size from a 20x30 egg-shape to a 61/2-foot circular,

MARINE CITY, MICH.—An election will be held in this city, February 6, to decide the question of issuing bonds in the sum of \$10,-000 for improvements.

BIDS OPENED.

NASHVILLE, TENN.—Synopsis of bids for furnishing 1,150 feet of 8-inch pipe and 1,150 feet of 6-inch pipe, opened January 10 by George Reyer, Superintendent of Water-Works: R. D. Wood & Co., Philadelphia, Works: R. D. Wood & Co., Philadelphia, Pa., 1,150 feet 8 inch, \$32.90; 1,150 feet 6 inch, \$32.90; Shickle, Harrison & Howard, St. Louis, \$32.40, \$32.40; Dennis Long & Co., Louisville, Ky., \$31, \$31; H. S. Jackson & Co., Nashville, Tenn., \$30.50, \$30.50; South Pittsburg Pipe Co., South Pittsburg, Tenn., \$30.45, \$30.45.

DOVER, N. H.—The contract for the new county jail has been awarded to the Pauly Jail Building & Manufacturing Company of St. Louis; price, \$26,000.

ALLEGHENY, PA. - The contracts for the iron ALLEGHEN, PA.—I he contracts for the iron mains or conduits, to connect the proposed new water service, have been awarded to the Wallen Manufacturing Company for nearly \$40,000. The water will be carried in iron pipes through the district in which it hight be contaminated. The proposed new reservoir will be thirty feet higher than Tivoli Lake, and will be known as the distribution reser-

SAN FRANCISCO, CAL.—Synopsis of bids for furnishing 15 cast-iron columns and one tier of rolled iron joists (contract No. 3); also to complete the iron steps leading to the colonnade of the Hall of Records (contract No 5) were received and opened January 5 by J. T. Washington, Secretary Board of City Hall Commissioners:

John Sheedy, contract No. 5, \$5,987.

M. J. Healy & Co., contract No. 5, \$8.000.

Deagan & Oxford, contract No. 5, \$5,528.

Reese Llewellyn, contract No. 3, \$36,700.

McGowan & Butler, contract No. 5, \$7,615. Savage, Sons & Co., contract No. 3, \$40,-

Sims & Morris, contract No. 3, \$37.500. O'Connell & Lewis, contract No. 3, \$34.-600.

Merriton, Ont., Can.—Synopsis of bids for furnishing about 750 tons of cast-iron water-pipe and a quantity of special castings, opened January 10 by R. Clark, Secretary Water Commissioners: Alex. Gartshcre, Ham-Water Commissioners: Alex. Gartshcre, Hamilton, Ont., 14, 12, 10, 8, and 4 inch pipe, \$38.08 per gross ton of 2,240 lbs.; specials, \$2.75 per 100 lbs. St. Lawrence Foundry Co., Toronto, 14, 12, 10, 8, and 4 inch pipe, \$39.30 per gross ton of 2,240 lbs.; specials, \$3 per 100 lbs. All on tracks, Merritton, Ont. Contract awarded to Alex. Gartshore, of Hamilton, Ont.

CHARLESTON, S. C.—Synonsis of bids for CHARLESTON, S. C.—Synopsis of Dids for furnishing iron castings to the Street Department to be used during the year 1888, opened January q by the Committee on Streets: Michael Kelly, Charleston, S. C., 2.6c. per lb.; Charleston Iron-Works, 2.7c. per lb. Bid awarded to Michael Kelly at 2.6c. per lb.



SANTA ROSA, CAL.—Synopsis of bids for

SANTA ROSA, CAL.—Synopsis of bids for constructing sewers and supplying 7,150 feet of vitrified pipe, opened January 3 by C. A. Hoffer, City Clerk:
Section 1. Third Street—John Hagan, Alameda, \$2,007, received contract; W. J. Schmidt, Berkeley, \$2,726.45; Thomas Dovle, San Jose, \$2,790; Jeffres & Murphy. San Francisco, \$2,335; King & Wener, San Jose, \$2,400; J. R. Carpenter, San Francisco, \$2,300; A. McRean, San Francisco, \$2,300;

\$2,260; J. D. Sullivan, San Francisco, \$2,300; A. McBean, San Francisco, \$2,968. Section 2. Fifth Street—W. J. Schmidt, Berkeley, \$3,074.45; Thomas Dovle, San Jose, \$3,159; Jeffres & Murphy, San Francisco, \$2,663; King & Wener, San Jose, \$2,980; J. R. Carpenter, San Francisco, \$2,540; J. D. Sullivan, San Francisco, \$2,900; A. McBean, San Francisco, \$3,254; John Ilagan, Alameda, \$2,274; received contract. Contractor furnishes everything and pays

Contractor furnishes everything and pays for it out of his contract. Said sewers are paid for by the city out of general fund.

KALAMAZOO, MICH.—Synopsis of bids for 18,000 feet cast-iron pipe, in different size and weight, 55 valves and 25 hydrants, opened January 11 by Chauncey Strong, City Clerk.

Bidders: Addyston Pipe and Steel Com-

pany. Cincinnati, iron pipe per ton, all sizes, \$26.45; special castings 2.3 cents.

New Philadelphia, O, Pipe-Works Company, pipe, \$29.50, specials 2½ cents per

Shickle, Harrison & Howard Iron Company, St. Louis, pipe \$29.50, specials 23/4 cents per pound.

Lake Shore Foundry, Cleveland, pipe \$26.85; specials 2½ cents Detroit Pipe and Foundry Company, De-

troit, 20 and 24 inch pipe \$27.14; 6 and 8 inch pipe \$27.43.

Mellert Foundry and Machine Company, Limited, Reading, Pa., 20 and 24 inch pipe \$32; 6 and 8 inch \$33. Camden Iron-Works, Camden, N. J., 20

Camden Iron-Works, Camden, N. J., 20 and 24-inch pipe. \$29,25; 8-inch, \$30.45; 6-inch, \$30.95; specials. 3 cents.
Warren Foundry and Machine Company, New York City, 24-inch, \$30.45; 20-inch, \$31.50; 6 and 8 inch, \$33.50.

Dennis Long & Co., Louisville, 24 and 20 inch, \$27; 6 and 8 inch, \$27.75; specials 2½ cents.

Valves and Hydrants.—Mellert Foundry and Valves and Hydrants.—Mellert Foundry and Machine Company, Limited, Reading, Pa., hydrants, \$27 each; 4, 6, and 8 inch valves, at \$10, \$15, and \$20 each.
Florence Iron-Works, Florence, N. J., hydrants, \$28; valves. \$9.75, \$13.95, and \$23.20.
James B. Clow & Co, Chicago, hydrants, \$27.49; valves. \$8.70, \$12.70, and \$22.60.
Galvin Brass and Iron Works, Detroit, hydrants, and \$25 for Calvin and \$25 for Calvin and \$25 for Calvin and \$25 for Calvin.

Galvin Brass and Iron Works, Detroit, hydrants, \$27 for the Galvin and \$30 for Galvin-Mathew; valves, \$8.50. \$13, and \$20.

I. S. Cassin & Co., Philadelphia, hydrants, \$30.25; valves, \$9.25. \$13.75, and \$21.

Jonson Foundry and Machine Company, New York, hydrants, \$36.50; valves, \$11, \$15,

and \$22.50.

Peet Valve Company, Boston, valves, \$8.75,

\$13.25, and \$22.
Daniel Kennedy, New York, valves, \$5.60,

Daniel Kennedy, New York, valves, \$3.60, \$13.25, and \$22.

James Flower & Bros., hydrants, \$26.50; valves, \$8, \$12. \$18.

Walter S. Payne & Co., Fostoria, O., hydrants, \$45; valves, \$8.50, \$13.75, \$20.°

Chapman Valve Manufacturing Company, Indian Orchard, Mass., hydrants, \$28.43; valves, \$9.40. \$14.60, \$21.66.

Whittier Machine Company, Boston, hydrants, \$26.75; valves, \$5, \$13.25, \$20.25.

National Tube-Works Company, Chicago, hydrants, \$30.40; valves, \$8.75, \$14, \$21.

National Tube-Works Company, Chicago, hydrants, \$30.40; valves, \$8.75, \$14, \$21, Crane Bros. Manufacturing Company, Chicago, hydrants, \$24; valves, \$8, \$12, \$20 Richard Beaumont, Kankakee, Ili., hydrants,

Bourman Copper and Brass Works, Cincinnati, hydrants, \$28.50; valves, \$8.50, \$13.85,

Franklin, O.—Synopsis of bids for furnishing pipe, castings, etc., opened January 13 by William Michael, of the Board of

National Physics of the Board of Water-Works Trustees:

Ohio Pipe Co., Columbus, O, \$27.83 per ton, f. o. b. Franklin, Warren Co., O.

New Philadelphia Pipe Co., New Philadel-

phia, O., \$27.24.

Dennis Long & Co., Louisville, Ky., \$33.

Shickle, Stuart & Howard, St. Louis, Mo.,

\$33.80. R. D. Wood & Co., Philadelphia, Pa., 10-inch, \$30.34; 6 and 8 inch, \$30.78; 4-inch,

R. G. Houston, Cincinnati, O., \$30.

Shickle, Harrison & Howard, St. Louis, special casting, 3c. per pound; special flange

special casting, 3c. per pripe, 4.2c.

Dennis Long & Co., Louisville, Ky., 3c.
R. D. Wood, Philadelphia, Pa., 3c.
R. G. Houston, Cincinnati, 2½c; 2¾c.
Ohio Pipe Co., Columbus, O., 2½c; 3½c.
New Philadelphia Pipe Co., New Philadel phia, O., 2½c; 3¼.
All t. o. b. Cars, Franklin, Warren Co., O.

McKeesport, Pa.-The contract for building the McKeesport and Bellevernon Railroad has been awarded to Messrs Drake & Stratton,

of Pittsburg, Pa.

GOVERNMENT WORK.

WICHITA, KAN.—Synopsis of bids for labor and material for the superstructure and com-pletion of the Court-House and Post-Office, opened January 10 by the Supervising Architect of the Treasury Department:

bids for iron work only in place.		\$6.480
With stone ashlar substituted from work only in place.	\$85,848 without add'n'! story. 1.09 679 with additional story. \$82,848 without add'n'! story. 113,597 with additional story.	
F. O. screen of oak	497.7 500 500 500 600 600 600 600 600	1.300
Kate per square foot for additional flooring.	\$ 252 252 253 254 255 255 255 255 255 255 255 255 255	9.
Amount Amount as per with an specification.	\$78.771 84.300 85.300 83.265 83.265 90.669 90.673 90.478 90.476 90.476 90.476 90.476 90.476 90.476 90.476	110,200
Amount as per specifi- cation.	\$60,381 60,850 67,861 69,173 70,724 73,465 73,477 70,477 70,477 70,477 70,477 70,478 88,239 88,398 83,600 83,600 85,600	85,900
Kind of stone.	reago, III Bedford and Warrensburg, Y. D. C. As per sample copy, III C. As per sample copy, III C. As per sample copy, III Bedford Course Creek Vailey Ohio bluestone Bedford Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Creek Vailey Course Course Bedford Course Creek Vailey Course Cre	Bedford
Віррвку.	Charles Sunberg & Co., Chicago, IIII Eedford and Warrensburg John O'Connor, Bullalo, N. Y. As per sample Larkworthy & Menke, Quincy, III Bedford Bedford Grouse Creek Valley Giol Winfield, Kan. Bedford Grouse Creek Valley Grouse Creek Valley Grouse Creek Valley Grouse Creek Valley Bedford Grouse Creek Valley Warrensburg E. F. Gobell, Chicago, III Bedford Warrensburg Bedford Warrensburg Bedford Green & Ilomas, Wichita, Kan. Bedford Green & Ilomas, Wichita, Kan. Bedford Green & Ilomas, Wichita, Kan. Bedford Green & Bedford Green & Warrensburg Warrensburg Co., Mankato, Minn. Bedford Greek Bassett, Chicago, III Gray & Co., Mankato, Minn. Bedford Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, III Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Bassett, Chicago, Minn. Warrensburg Greek Gre	Thomas H. O'Neil, Wichita, KanBedford

PHILADELPHIA, PA .- The bids for docking, PHILADELPHIA, PA.—The bids for docking, calking, and resheathing U. S. Lightship No. 45, opened January 19, 1888, at U. S. Lightheuse Inspectors' Office in Philadelphia, were: Jackson Sharp Co., of Wilmington, Del., \$2,510; Pusey-Jones Co., \$2,650; Enoch Moore, \$2,565.

Enoch Moore, \$2,505.

WASHINGTON, D. C.—Synopsis of bids for 200 galvanized shelves, 12'x8_n and 50 15'x8¾', for Treasury Department, office of Comptroller of Currency, opened January 16 by the Supervising Architect of the Treasury Department: William O'Donnell, \$47.50; Morgan, Thomas & Co., \$47.50; O. L. Wolfsteinerk & Co., \$55; Maryland Galvanized Works, \$68.75; John G. Hetzell & Son, \$72; Keen & Hagerty, \$75; John W. Geddes, \$78.50. **\$**78.50.

WASHINGTON, D. C.—Synopsis for bids for heating apparatus for new silver vault at the U.S. Treasury Building, opened January 14 by the Supervising Architect of the Treasury Department: Thomas Somerville & Sons, \$374; Johnson & Morris, \$315.

PROPOSALS.

(Continued from page vii.)

18TH OF JANUARY, 1888.

18th of January, 1888.

SEALED PROPOSALS will be received at the office of the Supervising Architect of the U. S. Trrasury Department at Washington, D. C., and open-d at a P. M. the 12th day of F-bruary, 1828, for supplying and putting in place complete, in the Court-House and Post-Office building at New Albany, Ind., a low-pressure return-circulation steam-heating and ventilating apparatus. Each prop-sal must be accompanied by a certified check for \$200, made payable to the order of the Treasurer of the United States. The right to reject any bids is reserved. The drawings and specification can be obtained by applying to this office, the office of the Superintendent, or at the Builders' Exchanges, at Philadelphia. Pa.: Cincinnati. O.; Pittsburg, Pa.; Milwaukee. Wis: Indianapolis, Ind., Ceveland. O., and Detroit, Mich.; the M-chanics' and Traders' Exchange, New York, N. Y.; the Mechanics' Exchanges, St. Louis, Mo.; the Builders' and Traders' Exchanges, Kansas City, Mo., and Chicago, Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange, Chicago. Ill., and the Permanent Exhibit and Fxchange.

TO BUILDERS.—Office of Light-House Engineer, Tenth and Eleventh Districts, No. 311 Woodward Avenue, Detroit, Mich., January 20, 1888. Proposals will be received at this office until 2 o'clock p. M. of Monday, the 20th day of February. 1888, for furnishing the materials and labor of all kinds necessary for taking down and rebuilding Skilligallee Light-House Tower. Plans, specifications, forms of proposal, and other information may be obtained on application to this office. The right is reserved to reject any or all bids, and to waive any defects. S. M. MANS-FIELD, Major of Engineers, Byt. Lt. Col., U. S. A., Light-House Engineer.

BPICK SCHOOL HOUSE.—Proposals are wanted at West Superior, Wis., until February to, for the erection of a brick school house. Address H. H. Grace, Director, Board of Education.

ELECTRIC LIGHTING.—Proposals are wanted at Cincincat., O., until January 30, for the lighting of certain postions of the cuy by electricity for one year from date of contract, according to specification. Address E., win Henderson, City Clerk.

LEAD PIPE, ETC.—Proposals are wanted at New-port, Ky., until February 6, for furnishing lead pipe and solder, stop and service cocks, stop cock boxes and stoneware drain pipe in such quantities as may be required until January 11, 1889. Address B. R. Morton, Superintendent Water-Works.

DREDGING.—Proposals are wanted at New York City, until January 3t, for doing the work of dredging and removing from Mott Haven Canal 15 443 cubic yards of mud and deposit, more or less, with price per cubic yard; also price for the job. Address James C. Bavles, President Health Department.

BUILDING PIER.—Proposals are wanted at New York City until January 27, for removing the existing pier at the foot of West Thirty-eighth Street, and for preparing for and building a new wooden pier and approach at the foot of said street, and for repairing the existing crib-builkhead thereat. Address the Department of Docks, Pier 1, North River.

WATER-WORKS.—Proposals are wanted at Joliet, Ill., until February 1, for the construction of a twenty-mile system of water-works. Address Mayor John D Parge.

HEATING AND VENTILATING APPARATUS.—Proposals are wanted at Cleveland, U., u.t.il January 23, for the heating and ventilating of a hospital building. Address Messrs. Lehman & Schmitt, Architects, Room 31, Benedict Block, Cleveland, O.

STEAM-HEATING. — Proposals are wanted at Washington, D. C., until February 12, for supplying and putting in place, complete, in the Court-House and Post office at New Albany, Ind., a low-pressure return-circulation steam-heating and ventilating apparatus. Address Will A Freret, Supervising Architect of the Treasury Department.

BUILDING ARMORY.—Proposals are wanted at New York City until January 30, for furnishing materials and performing the work in theerection of an arinory building on Fourth Avenue, extending from Ninety-fourth to Ninety-fifth Street. Address the Armory Board, "Staats Zeitung" Building.

MASONRY WORK.—Proposals are wanted at New York City, until January 30, for furnishing materials and performing masonry work in the erection of an armory building on Fourth Avenue, extending from Ninety-fourth to Ninety-fifth Street. Address the Armory Board, "Staats Zeitung" Building.

CAST-IRON WATER-PIPE.—Proposalsare wanted at Rochester, N. Y., until January 27, for furnishing 407 tons straight p pe, 10 000 pounds special castings, etc., according to specifications. Address Thomas J. Neville, Clerk of b xecutive Board.

ADDITION TO SCHOOL.—Proposals are wanted at Brockport, N. Y., until February 9, for the erection of an add tion to the State Normal School in this city. Address Dayton S. Morgan, President Local Board, State Normal School, Brockport, N. Y.

STREET LIGHTING.—Froposals are wanted at Lancaster, Pa., until February 17, for lighting portions of the city by electricity, other portions by coal-oil or other material, the public buildings by eas, etc., according to specifications. Address William Riddle, Charman Lamp Committee, Mayor's Office, Lancaster, Pa.

PUMPING MACHINERY.—Proposals are wanted at Sandusky, O., until Jacuary 31, for a pumping-engine of 5,000,000 or 7,500,000 gallons daily capacity, etc., according to specification. Address James J. Kelpley, Trustee, office of Board of Water-Works Trustees, Sandusky, O.

STFAM AND GAS FITTING.—Proposals are wanted at New York City, until January 30, for furnishing materials and performing the steam heating and gas fitting work in the erection of an amory building on Fourth Avenue, extending from Ninetviourth to Ninetvifith Street. Address the Armory Board, "Staats Zeitung" Building.

PROPOSALS.

SEWER CONSTRUCTION.—Proposals are wanted at Amsterdam, N. Y., until March 15, for constructing three miles of sewers. Address the Sewer Commission.

HOSPITAL BUILDING.—Proposals are wanted at Fort Sully, D. T., until February 13, for the condrastion of a brick hospital building. Address A. F. Rockwell, Quartermaster U. S. Army, Chief Quartermaster.

WATER-WORKS MATERIAL. - Proposals are wanted at Althona. Pa., until January 26, for furnishing the Department of Water with taos, drills, galvasized pipe, plus, etc. Address Thomas H. Wigging Chairman of the Board of Water Commissioners.

SEWER CONSTRUCTION.—Proposals are wanted at New York City, until February 1, for constructing sewers in certain streets. Address the Department of Public Works.

WATER WORKS.—Proposals are wanted at Marion, Va., for a complete system of water work. No date specified. Address J. H. Francis, Town Recorder.

BRIDGES.—Proposals are wanted at Raleigh, N.C., for the erection of two bridges. No date specific Address Jesse Winburn.

HOT WATER HEATING.—Proposals are wanted at St. Paul, Minn, until February 7, for heating with hot water the buildings known as the Founding Home and Annex to the City Hospital. Address Thomas A. Prendergast, City Clerk.

PAVING.—Proposals are wanted at North Des Moines, Iowa, for paving, etc., certain streets, "ati February 6. Address Ernest B. Gaston, Recorder.

IRON-WORK.—Proposa's are wanted at Washington, D. C., until February 16, for furnishing adducting in place complete the iron beams and column required for the Court-House, Post-Office, etc. bulking at Denver, Col. Address Will. A. Freret, Super-

BUII.DING.—Proposals are wanted at Washington, D. C., until February q, for the construction of a lite-saving station at Michigan City, Ind. Addres S. I. Kimbail, General Superintendent U. S. Life-Saving Service.

IRON-WORK.—Proposals are wanted at Washington, D. C., until February 16, for all the iron terrecta, slate and copper work, etc., required for the floors and roof of the court-house, etc., buildie at Keokuk, Iowa. Addr-ss Will. A. Freret, Supervision

TOO LATE FOR CLASSIFICATION.

SEAL HARBOR, ME .- This place is to be supplied with water by the Seal Harbor Water Co. The work of constructing the system will probably begin in the spring.

KUTZTOWN, PA .- The question of erecting a water-works system here is being discussed.

OCONTO FALLS. WIS .- The Falls Water Power Co. has organized to erect a system of water-works. The capital stock is \$15,000.

CRESTON, IOWA .- It is reported that an extensive system of water-works is to be erected here by the city. The report states that there will be eight miles of mains and eight hydrants. WAHOO, NEB .- The Wahoo Water-Works

Co. will erect a system here, the reported cost of which is \$75,000. ROCHESTER, PA .- The new water-works

commany is trying to secure a site for its work and will issue \$200,000 in stock at once.

SPRINGWELLS. MICH.-Efforts are being made by the officials of this place to procure; supply of water from the Detroit water-works

WASHINGTON, Mo.—The people of this place will decide for or against water-works by a popular vote at an early day.

HIGHLAND PARKSIDE, N. Y.—A system of sewers is to be constructed in this place. 4 suburb of Buffalo, this spring.

IRWIN, PA.-It is reported that F. Z. Schellenterg can give information of a projected system of water-works for this place.

Buffalo, N. Y.—Concerning the report that a sewerage system was to be established at Highland Parkside, a suburb of this city our correspondent writes: "Nothing has been done except to direct this department to prepare plans for a system." pare plans for a system.

SAGINAW CITY, MICH.—It is said that the Flint & Pere Marquette Railway will build a large bridge over the Saginaw River at this place.

PLYMOUTH, PA.—For details of a large bridge to be erected here address Thomas Lazarus, Harrisburg, Pa.

ATCHISON, KAN. — Considerable bridge building may be expected here at an early date.

FORT WORTH. TEX.—There is considerable talk of erecting a \$25,000 bridge in this

WACO, TEX .- The officials of this place will soon consider the question of a water-supply, as the contract with the present company expires in July.

SCRANTON, PA .- The Meadow Brook Water Company, Scranton, Pa., has been incerporated. Capital stock, \$10,000. William porated. Capital stock, \$10,000. Connell, and others, incorporators.

MARINE CITY, MICH.—An election will be held here February 6, to decide the question of bonding the city in the sum of \$8,000 to extend the water-works system in the Third Ward.

HANOVER, MASS.—It is reported that water-works are to be established here.

ROCKFORD, ILL.—The question of constructing a sewerage system is being agitated

WHE LING, W. VA.—It is reported that the Wheeling & Harrisonburg Railroad will build a bridge and tunnel in this city. J. M. Camcen can probably give details.

SALMON FALLS, MASS.—The city officials contemplate erecting a new bridge.

LAUREL, DEL.—A bridge is to be erected here by the Pennsylvania Railroad Co.

RALEIGH, N. C.—Two bridges are to be erected here, the details of which can be had by addressing Jesse Winburn, this city.

TOLEDO, G.-Address the City Engineer for details of several bridges which are to be erected here soon.

MINNEAPOLIS, MINN.—General Manager Manvel, of the Manitoba road, has announced that the company will build a truss bridge, seventy-two feet long, over their tracks on Lyndale Avenue. The Minneapolis and St. Louis will build a direct-support bridge over its right-of-way.

MINNEAPOLIS, MINN -Contract for building the Davion bridge has been awarded to A. T. Bayne & Co. for \$10,014.

LOCKPORT, N. Y.—Concerning the report that a bridge was to be erected here, our cor-respondent writes: "The proposed new bridge at Cottage Street, in this city, is to be the work of the State, being a canal bridge."

WASHINGTON, Mo.—An election is to be held here soon to settle the question of establishing gas works.

WASHINGTON, D. C .- The contract for the construction of a pneumatic gun carriage has been awarded to the Pneumatic Gun Carriage and Power Company, of Washington, D. C. for \$19,000.

WASHINGTON, D. C .- The following bids were opened at the office of the inspector of the Third Lighthouse District, January 13, for (a) 125 spruce spa buoys deliverable at Tompkinsville, N. Y.; (b) 25 do deliverable at New London, Conn.; (c) 20 do deliverable at Burlington, Vt.: Burlington,

Rumery, Birnie & Co., Portland, Vt.; (a)

**Rumery, Birnie & Co., Portland, Vt.; (a) \$2,035 (accepted): (b) \$250; (c), no bids. Albert H. Simonton, Portland, Me. (a) \$2,302.50; (b) \$187.50 (accepted): (c) \$207.50. Frank M. Clement, Portland, Me. (a) \$2.405; (b), no bid; (c), no bid.

The buoys for Burlington, Vt., will be purchased in one market.

chased in open market.

BROOKLYN, N. Y.—The bid of P. J. Carlin of \$85.500 for the contract for the erection of an extension to the Thirty-second Regiment Armory has been accepted by the Kings County Board of Supervisors.

MINNEAPOLIS, MINN.—Bids have been re-Shingle Creek station as follows: L. C. Bisbee, \$44.355; I. C. Cutter, \$43.900; Trainer Bros. \$49.500. Action deferred.

WASHINGTON, D. C.—Synopsis of bids for

WASHINGTON, D. C.—Synopsis of bids for furnishing 108 shackles for lightship chains, opened at the office of Inspector of Third Lighthcuse District January 13:

New Jersey Steel and Iron Company, Trenton, N. J., for 36 shackles for ½-inch chains, 6½c.; 18 for 1½-inch chains, 7c.; 18 for 1½-inch chains; 36 for 1-inch chains, 9½c. Accepted.

cepted.
West Lebanon Rolling-Mill Company, Le-

West Lebanon Kolling-min banon, Pa., all sizes, 7.6c.
Bradlee & Co., Phiadelphia, Pa., for 1½-inch chain, 7.9c.; 1½-inch chain, 7.9c.; 1½-inch chain, 8.4c.
G. M. Stanwood & Co., Portland, Me., all sizes, 1234c.

sizes. 1234c.
E. J. Codd & Co., Baltimore, all sizes, 15c.
Theodore Smith & Bro., Jersey City, N. J., all sizes, 20c.

MINNEAPOLIS, MINN.—Synopsis of bids for erecting the North Minneapolis pumping-station, opened January 10 by Andrew Rinker, City Engineer: S. C. Clute, Minneapolis, \$42,900; L. C. Bisber, Minneapolis, \$44,355; Trainor Bros., Minneapolis, \$49,500.

LINCOLN, NEB .- The bids for the construction of the new court house for Lancaster County were opened several days ago and found too high by \$50,000.

THE Chicago, St. Paul and Kansas City Railway Company (formerly Minnesota and North-western); place of business. Dubuque, Iowa; the capital stock is \$25,000,000.

THE Ortonville and Southern Railway Company, to run a line of road from Ortonville, south-west by Pipe Stone to the west line of the State; capital stock, \$3,000,000.

MILWAUKEE, WIS .- Harbor improvements and dredging to the amount of \$30,000 will be expended in this city.

MILWAUKEE, WIS .- The sum of \$10,000 will be expended for building retaining walls on the river from Cherry Street to Point Street

PUBLICATIONS RECEIVED.

CATALOGUE OF BOOKS relating to Civil and Mechanical Engineering Arts, Trades and Manufactures. Published and sold by E. & F. N. Spon. 1887. 16 mo., 116 pp., paper.

CATALOGUE OF POLYTECHNIC LIBRARY. Published by Baudry & Co., Paris. 1287. 24 mo., 48 pp., paper.

VILLE DE BRUXELI.ES. Rapport fait au Conseil Communal en Seance du 3 Octobre, 1887. Par le Collège des Bourgmestre et Echevius en execu-tion de l'artide 70 de la loi des 30 Mars, 1836. 12 mo., 228 pp., paper. Bruxelles: Ve Julien Baertsoen. 1887.

THE MECHANICS' LIEN LAW OF ILLINOIS, as amended by Act of 1887. Compiled by C. W. Cooper, Attorney at Law. Published by the Building Budget, Chicago, 1887. 8vo., 57 pp., paper.

REPORTS TO THE AQUEDUCT COMMISSION of the City of New York, on researches concerning the design and construction of high masonry dams. By B. S. Churen, Chief Engineer, and A. Fteley, Consulting Engineer, in view of the proposed building of the Quaker Bridge Dam. 1887. 11\(\frac{1}{2}\times \gamma_2\frac{1}{2}\), 48 pp., with many sheets of tables and illustrations.

STEAM BOYLER EXPLOSION IN THEORY AND PRACTICE. By R. H. Thurston, M. A., Doc. E. g., Director of the Sibley College, Cornell University. 12 mo., 173 pp. New York: John Wiley & Sons. 1887.

ANNUAL REPORT OF THE WATER-WORKS COMMISSION of the City of St. Catherines to the City Council. Together with the Report of the Superintendent, for the year ending December 31, 1886. 8 vo., 37 pp., paper. St. Catherines: The Laurent Persister Company. 1886. 8 vo., 37 pp , paper. Journal Printing Company.

ILLUSTRATED CATALOGUE of the Newton Machine Tool Works. Philadelphia, 1887. 16 mo., 64 pp., paper.

REPORT OF PROCEEDINGS OF THE SEV-ENTH ANNUAL MEETING of American Water-Works Association, held at Minneapolis, Minn., July 13-16-18, 1387. 8 vo., 120 pp., paper. Hanniba', Mo.: Standard Printing Co. 1887.

HOW TO GET STRUNG AND HOW TO STAY SO By Will.am Blakie. 16 mo., 296 pp. New York: Harper & Bros.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apar their-house; ten, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

437-439 W 35th, 2 br flats; cost, \$32,000 l; o, Moore & Brennan; a, Keister & Wallis

300 Washington, brick storage and stable; cost, \$16 000; o, Max Ames; a, Wm Graul S s 70th, 400 w 9th av, 3 br dwells; cost, \$57,000 all; o, C Steinmetz

68 Broome, br flats and stores; cost, \$15,-000; o, C Friedman; a, Rentz & Lange

70 Broome, br flats and stores; cost, \$18,-000; o and a, same as above

103 Allen, br flats and stores; cost, \$15,000; o, Henry Harris; a, Rentz & Lange

73 Beekman, brick store; cost, \$25,000; o, William Hustad; a, Jas M Farnesworth

310-312 W 18th, 2 br flats; cost, \$36,000 all; o, David Richey; a, G A Schellinger

BUILDING INTELLIGENCE.

W s 9th av, 50 s 67th, 2 br flats and stores; cost, \$36,000 all; o, Henry E Hillier; a, Lamb & Rich

S s 40th, 141 e 1st av; br gas works; cost, \$12,000; o, Equitable Gas Light Co; a, A W Putnam Cramer

ALTERATIONS-NEW YORK.

S w cor 8th av and 128th, br ten and store; cost, \$14,000; o, J J Alexander; a, Julius Munchwitz

99 E Broadway, brick ten; cost, \$7,500; o, A H Spektasky; a, Fred Ebeling

32 Nassau, br office bldg; cost, \$250,000; o, Mutual Life Ins Co; a, Chas W Clinton

146-152 Nassau, br office and store; cost, \$9,000; o, American Tract Society; a, J E

608 E 16th st, br ten and stores; cost. \$18,-000; o, C Downey; a, A I Finkle

149 W 20th st, br stable; cost, \$20,000; o, F Neumer; a, J Kastner

51st st, n s, 269 e 1st av, 3 br and stone tens; cost each, \$18,000; o, M& E C Schaefer; a. I Kastner

56th st. n w cor Park av. br ten: cost. \$65 000; o, Bijou Apartment Company; a, R. S. Townsend

114th st, n s, 100 w 2d av. 7 stone tens: cost each, \$15,000; o, John Livingston; a, F T Camp

1441 Av A, br and stone ten; cost, \$18,000; o and b, John Van Dolsen; a, George B Pelham

BROOKLYN.

Rapelyea st, s s, 100 w Hicks st, br ten; cost, \$10,000; o, John Collins; a, P Walsh

S s Starr, 100 e Hamburg av, 4 fr dws; cost, \$17,200 all; o, Aug Sedlemeier; a, Frank Holmsberg

36-38 Columbia pl, 2 br dws; cost, \$15,000 all; o, C Lanigin; a, not given

S s Stockton, 85 e Marcy av, fr dw; cost, \$7,000; o, Richard Healey; a, I D Reynolds

S e cor Marcy av and Stockton st, 4 fr dws and stores; cost, \$28,000; o and a, same as above

E s Stuyvesant av, 22 n Macon st, 2 br dws; cost, \$10,000 all; o and a, A Miller

E s Stuyvesant av, 61 n Macon st, 2 br dws; cost. \$10,000; o and a, same as above

S s oth st, 170 w 5th av, br dw and store; cost, \$9,000; o, A G Calder; a, W M Calder

Ws Clinton av, 572 n Myrtle av, 3 br dws; cost, \$30,000 all; o, J J Richardson; a, Parfitt Bros

N s Atlantic av, 440 n Albany av, 10 br dws; cost, \$45,000 all; o, Julia P Kennedy; a, C A Schellinger

 \cdot S s 10th st, 240 w 9th av. 4 fr dws; cost, \$20,000 all; o, J F Ransom and R S T Stevens; a, I D Reynolds

Es Howard av, 70 n Atlantic av, 4 fr dws; cost, \$12,000 all; o, James Peters; a, Louis H Putnam

S s McDonough st, 80 w Throop av, 4 br dws; cost, \$44,000 all; o, John Fraser; a, same E s Bushwick av. 61 s Moore st. 2 fr dws

and stores; cost, \$9,600 all; o, Chas Leimer; a, H Vollweiller

S s 10th, 240 w 9th av, 3 br dwells; cost \$15,000 all; 0, J F Ranson and R T Stevens; a, as above.

N s Rutledge, 75 e Marcy av, 4 br dwells; cost, \$24,000 all; o, John Auer; a, David Acker & Son.

N s Central av, 40 s Ivy, 2 fr dwells and stores; cost, \$9,200 all; o, Philip Miller; a,

Ss Starr, 100 e Hamburg av, 5 fr dwells and stores; cost. \$12,000 all; o, Aug Sedlmeir; a, Frank Holmberg.

N w cor Irving av and Magnolia, 2 fr dwells and stores; cost, \$10,000 all; o, S W Turner; a, as above.

MISCELLANEOUS.

WINONA, MINN-A Baptist Church will be erected here

DETROIT, MICH .- 1151 Jefferson, brick store; cost, \$10,000; o, Joseph Kengel.

221 Putnam, br dwell; cost, \$7,000; o and a, A C Varuey.

Warren, br dwell; cost, \$7,000; o, H B Moore; a, R Parsons.

BUILDING INTELLIGENCE.

ST PAUL, MINN-Mendota, nr Margaret st, 2 story fr dwell: cost, \$7,000; o, Henry Weisnill

Messrs Hodgson & Stem have drawn plans for a row of nine houses, to be erected in lower town next season at a cost of about \$75,000 They have also had orders to ad-**\$75,000** vertise for the bids, and are making preparations to begin the work of construction early in the spring

LOWELL, MASS.—School, 5 fr ten blocks a, Gilman Brothers.

Watson av, 5 fr ten blocks; o, George Cummings; b, Adams Co.

HARRISBURG, PA.—Nothing over \$7,000 in value to report this week.

BALTIMORE, MD.—Bond nr Pratt, 3 story br bldg; o, George Umbach.

Fremont nr_Lanvale, 5 3 story br bldgs; o, Joseph M Cone.

Cor Lex and Mount, 3 3 story br bldgs; William H Wehn.

Mount nr Lex, 4 3 story br blds; o, William H. Wehn.

Cor Lee and Park, 4 story warehouse; o, Emanuel Greenbaum.

YOUNGSTOWN, O.—The First Presbyte-rian Church of this city is being remodeled and having a gallery put in.
Nothing over \$7,000 to report.

DENVER, COL.-\$2.971,770 was expended for bldgs last year according to the Denver Republican. Of this, \$50.500 was for schools. \$20,400 for churches, and \$1,175,700 for

LOUIS, MO. - Montgomery and N Market, 4 br dwells; cost, \$8,000; o and a, H Feuerbach.

business bldgs, the balance dwellings and alterations and miscellaneous bldgs.

6 valued at less than \$7,000.

WARRICK COURT-HOUSE, VA.-Our correspondent writes: "The Board of Su-pervisors has caused plans to be made for a new court-house, and will advertise for bids about the 28th instant."

HOLYOKE, MASS.—The Hibernians are to erect a building for themselves on Front street, to cost about \$10,000.

ST. PAUL, MINN .- Main, nr Hastings, alteration to stone building; cost, \$10,000; o, James Middleton.

Plans for 100 houses, to cost from \$1,500 to \$3,000 each, have been placed in the hands of building contractors by the South St Paul Stock Yards syndicate.

TRENTON, N. J.—The Y M C A will expend \$16,000 in an edifice here. The architect has not been selected.

NEWARK, N. J.—No architect has been selected for the new Y M C A building to be erected in this city.

BANGOR, ME.—The Y M C A will erect a \$30,000 structure here. No architect has been selected. EVERETT, MASS.—Address W. T Moore, Secretary Y M C A, for details of new edi-

fice to be erected here. BOSTON, MASS.—Carruth, cor Fulton, fr dwell; cost, \$14,000; o, Geo H Quincy; a, Allen C Kenway; b, F M Severance

Sawver av, fr dwell; cost, \$10,000; o, Isaac F Thompson; a, Fuller & Delano; b.

I F Thompson Lombard, cor Bushnell, fr club house. cost, \$7,000; o, Ashmont Association; a, E J Lewis, Jr; b, F M Severance

MILWAUKEE, WIS .- For repairs on school houses \$25,000 has been appropriated.

No buildings over \$7,000 to report; eight less than \$7,000.

PALMYRA, WIS .- A factory for the manufacture of smokeless and noiseless engines will be built. Fifty cottages for workingmen will also be built.

ST. LOUIS, MO.-Eighteen unimportant permits.

GRANTSBURG, WIS .- A court house will be rebuilt here in the spring.



BUILDING INTELLIGENCE.

CANTON, O—The Y M C A will erect a bldg here, and has not as yet selected an architect

ALBANY, N Y—Fuller & Wheeler are to make the plans for a \$100,000 building for the Y M A of Albany. Building to include public ball, library, etc

HARRISBURG. PA.—Nothing new over the value of \$7,000 to report this week. Bldg outlook fair for the spring

WORCESTER, MASS.—Cedar st, fr dwell; cost, \$7,000; o, Mrs M S Dunn; a, S C Earle; b, J A Courtemanche

ANCASTER, PA. — East Chestnut Street, 4-story office bldg, Pompeian brick front, India limestone trimmings, tile roof; cost, \$8,000; o, Foltz Es-tate; a. C Emlem Urban; b, Erisman & LANCASTER. Eicholtz

BIRMINGHAM, ALA-A court house to cost \$250,000 is to be erected in this city

PITTSFIELD, MASS—A brick stock house, to cost \$25,000, will be erected by Byron

NEW HAVEN, CONN—A \$150,000 library bldg is to be erected for Yale College

YORK. PA.-A market house 104x250, to cost \$45,000, will be erected here. John F Irwin will give information

SOUTHBRIDGE, MASS—A high school bldg is to be erected here. None of the contracts have as yet been let.

WILKESBARRE, PA—The Y M C A will expend \$18,000 in a bldg here. For complete details address Treasurer C Wal-

EXCELSIOR, MINN-The Excelsior Yacht Club will erect a large boat house. Address the President of the club for details

BALTIMORE, MD—A Baptist Chuch to cost \$20,000 will be built here

PROVIDENCE, R I-Rear Whatcheer bldg, br boiler house; o, Whatcheer Corporation; a, Stone, Carpenter & Miller

BALTIMORE, MD—McCullough nr Wilson, 2 3-story br buildings; o, T W Bedford & Co

GREENVILLE, MICH.—A church and parsonage to cost \$20,000 will be erected by the Methodist Episcopal Society. No plans have been adopted as yet. For information address the pastor.

GLOUCESTER, MASS—A \$25,000 Methodist Church is to be erected here.

MOUNT PLEASANT, PA-A large hotel is to be erected here; for details address Wm R Simpson.

SARANAC LAKE, N Y—A new hotel, to cost \$200,000, is to be erected here in the spring by Mr Agnew, of New York.

FINDLAY, O—For details of a temple to be erected here by the Odd Fellows, and for which no no architect or plans have been selected, address Col C E Niles, of the First National Bank.

ROCHESTER, NY-Architect A Druiding, of Chicago, Ill, has plans for a church for St Michael's Church Society of this place; the edifice will cost \$80,000.

TOLEDO, O-Glass works to cost \$60,000 will be erected here; W H Maher is one of the committee on building.

SIOUX CITY, IA—A 3-story stone structure is to be erected here by the Y M C A; no architect has been selected.

OAKLAND, CAL-Several wharves are to be constructed in this city, at a total cost of \$30,000; City Engineer Morgan has charge of the plans.

RUSH CENTRE, KAN-A court house for Rush County will be erected here; A S Holt, banker, at this place, can give details.

DELAWARE, OHIO.—The Ohio Weslevan University will build three new buildings, a music hall, art hall, and gymnasium.

LOS ANGELES, CAL.—A city hall will be built here as soon as contracts can be made.

BUILDING INTELLIGENCE.

PHILADELPHIA, PA—1602-4 S 19th st, 2 dwells; b, Sam'l McClellan

34th, below Race, 2 dwells; b, J E & H L Pennock

Sunnyside st, ab 35th, 4 dwells; b, John F Reichardt

Point Breeze, 3-story br bldg; o, Atlantic Refining Co

Lambert, ab Susquehanna av, 30 2-story dwells; b, E Bethell

Pulaski, bet Coulter and Bath, 2 dwells;

PHILADELPHIA, PA-The Athletic Club of the Schuylkill Navy contemplates erecting a club-house to cost \$75,000.

CHICAGO, ILL.—572-74 Throop, br flats; cost, \$8,000; o and b. J V Bemis, Jr.

040-42 Walnut, br flats; cost, \$10,000; o, C R Sullivan: a, Geo Guessing; b, Erickson & Wilson.

330 State, br st and flats; cost, \$8,000; o, John G Garibaldi, a, Treat & Foltz; b, A Biemolt.

974-80 W Jackson, br dwell; cost,\$10,000; o, G J Titus; a, Geo Scoville; b, J E Davis. 3568 Grand st, br dweil; cost, \$8,000; o, J F Whitney; a, T W Wenis.

200-02 W 12th, br st and flats; cost, \$13,-200; o, Dr. Krost; a, W L Carroll; b, J E

149-57 Madison, br st and office; cost, \$100,000; o, Wirt D Waiker; a, Holabird & Roche.

2801 5th av, br flats, cost, \$8,000; o and a, Martin Burdock; b, W Thiele.

Vincennes av and 37th st, 6 dwells: cost, \$30,000; o, John Morris; a, W G Barfield. 2300 Wentworth av, br st and flats; cost \$9,000; o, Mr Loesche; a, Edw Steude.

South Side, br double flat bldg; cost, \$17,-000; o, C E Robinson; a, Edw Steude. Rosalie Court, Hyde Park, fr and st dwell;

cost, \$10,000; o, R L Morley; a, E C John-

Dearborn and 51st, Lake Township, br block of stores; cost, \$25,000; o, Hy Sweet; a, R G Penticost.

452 Harrison, br st and flats; cost, \$10,000; o, James O'Brien; a, Julius Speyer.

Archer av and Wood st, br st and flats; cost, \$16,000; o, F Bischoff; a, Julius Zittel. 915-23 W Jackson, br dwells; cost, \$26,-000; a, Geo Raymond; a, F W Hinsdale.

West Side, 5-story malt-house; cost, \$75,-000; o, Brood Brewing Co; a, C H Gottig. Eighteen buildings costing less than \$7,000 each.

MECHANICSVILLE, N. Y. - A highschool building, to cost \$16,000, is to be erected here. W. F. Cummings, architect, of Troy, N. Y., has the plans, and none of the contracts have been let yet.

EATONTON, GA.—Several schoolhouses are to be erected here. Address the Mayor for details.

ENANGO, PA.-The Odd Fellows will erect a costly structure here. For details address the secretary.

ST. PAUL, MINN .- "The Capitol" apart-T. PAUL, MINN.—"The Capitol" apartments house is to be erected in the spring on St Peter Street, adjoining the Windsor Hotel. The building will be constructed of brick and stone, and will contain thirty-two apartments of three and four rooms each. The officers of the Capitol syndicate are J H Hodgson, President; J H Gregory, Vice President and Treasurer, and E A Jaggard, Secretary. Secretary.

Plans have been prepared by Worth & Haas for a three-story building, with stores and flats, to be erected in the spring by John Robertson, at the corner of St. Peter and College Avenue. The building is to be constructed of pressed brick, with stone trimmings. The flats will number eight, three rooms each. The structure will cost \$15,000 rooms each. The structure will cost \$15,000

PROVIDENCE, R. I.—Seven permits for buildings costing less than \$7,000.

ALLEGHENY, PA.-McClure av, one story br church, stone and terra cotta trimming; cost, \$3,000; o, Presbyterians; a, J L Faxon, Boston, Mass.: b, Rose & Fisher; J B Chambers, Supervising Architect, Allegheny.

BUILDING INTELLIGENCE.

MINNEAPOLIS.—Cor Nic av and 6th, br store; cost, \$200,000; o, William Donaldson; a, Long & Kees.

8th av, s e, and 2d, br warehouse and factory; cost, \$50,000; o, F E Little.

2411 Bloomington av, br store and flat; cost, \$10,000; o, J Earthagen.

420 Hennepin av, br store; cost, \$20,000; o, R L Berglund.

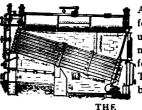
Boulevard av, bet 20th and 21st, fr dwell; cost, \$8,600; o, J A Ridgway.

1st, bet 28th and 29th, fr planing mill; cost. \$14,000; o, De Soto Lumber Co.

Park av, nr 18th, fr dwell; cost. \$22,000; o, Webster & Hoit.

5th av and E 24th, br store; cost, \$20,000; o, O C Dahl.

"STEAM



for every steam user and engineer, published for free DIS-TRIBUTION by

Babcock & Wilcox Co.,

WATER-TUBE BOILERS, 107 HOPE ST., GLASGOW.

30 CORTLANDT ST., NEW YORK.

30 CORTLANDI SI., NEW Branch Offices:

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New Orleans, 57 Carondelet St.
Pitisburg, Room 64, Lewis Building.
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San Francisco, Hinckley, Spiers & Hayes,
561 Mission St.

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EXCEPTIONAL facilities for the manufacture of fine Architectural Cabinet Wood-Work and Interior Decorative Work from the designs of architects and our own artists.

An inspection of our Warerooms is solicited,

Broadway and 53d St.,

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ABENDROTH & ROOT'S IMPROVED

Water-Tube Steam-Boiler.

UR new boiler has successfully demon. strated its superiority by practical use under most trying circumstances. We have confidence, therefore, in our ability to meet the most exacting requirements, and invite a critical exam. ination of our new system of construction by all who contemplate purchasing boilers.

ABENDROTH & ROOT MFG. CO. 28 CLIFF STREET, NEW YORK.

Correspondence soli-ited.

THE THOMAS GIBSON COMPANY of Cincinnati. O., who were the first importers and manufacturers of sanitary firtures, have introduced a new closet, The CAR-LISLE PEDESTAL, front outlet," the distinctive features of it being SIMPLICITY, PERFECT WASH, scientific construction, and moderne cost. A handsome circular and price-list will be furnished ON APPLICATION.

273 Walnut Street, CINCINKAN

Globe Steam-Heater Co

Manufacturers of Steam-



Heaters, High and Low Ртеврите Boilers.

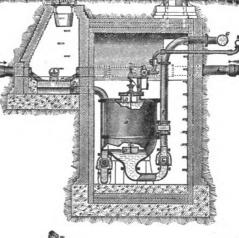
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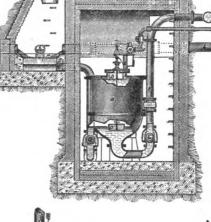
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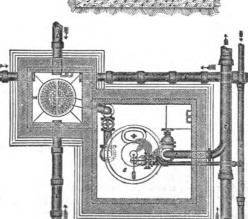
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To Borough Engineers, Local







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AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE PANAMA CANAL IN 1887.

Our readers will bear in mind that the estimates and opinions contained in the valuable and interesting paper of Lieutenant Rogers, of which we give an abstract on another page, relate, with the exception of part of the final note, to De Lesseps' original plan of a thorough cut or sea-level canal.

His recent modification which contemplates an elevated lake in the Culebra division, with locks on either side, will, of course, very largely reduce the required excavation, and for the present render the Gamboa Dam unnecessary, as the proposed Culebra Lake is expected to answer as a regulator for the waters of the Chagres River.

This modification is said to be proposed merely as a temporary measure to hasten the opening of the canal and diminish its first cost, the sea-level waterway being still promised as a finality, and our explanation is to prevent our readers from confusing the two plans or forgetting that the lock plan is of very recent adoption.

PLAN FOR VENTILATING MONTREAL SEWERS WANTED.

WE publish in another column a typical letter from the Secretary of the Montreal Board of Health. We do not mean typical of the Montreal Board of Health, for that we hope it is not, but of the methods too often employed by municipal authorities in need of professional advice on engineering subjects.

We do not suppose that any of the gentlemen composing the Montreal Board of Health would, if seriously ill, send to a New York physician a general statement to that effect and expect to receive in return advice of any value. Still less would they be mean enough to expect or wish the physician to give it without pay, and yet that is precisely what they have done in their official capacity, and the folly and meanness are as apparent in the real case as in the supposed one. They would not dream of taking such a course on a legal question of far less importance.

But suppose we were willing to give for nothing the advice which our professional brethren in Montreal might rightfully expect to be called on to give for pay, what would be the value of advice given on such vague and scanty data in a case confessedly of unusual difficulty, and what intelligent use could the Montreal authorities make of even the best advice without the assistance of a competent engineer? Let them, therefore, start right and employ a competent engineer to begin with. They need not go far for one. There are a number of capable civil engineers in Montreal. Of these we believe there are about a dozen members of the American Society of Civil Engineers, and one of these is the recently elected president of the society. We do not know whether any of these gentlemen are experts on sewer ventilation, but we have little doubt that any of them could give sound advice on the general question, and would know enough to call in a specialist when occasion required.

It is high time that all corporations confronted by important engineering problems should realize that sound economy as well as common sense call for the prompt employment of a skillful engineer. In such a case pre-eminently "the best is the cheapest."

THE ICE CROP.

ABOUT this time, as the old almanacs used to say, expect the cutting and storage of impure ice. As our readers know, it has been fully demonstrated that ice cut from water contaminated by sewage contains dangerous elements in the form of bacteria whose vitality is not destroyed by freezing or even by exposure to temperatures much below the freezing point. It has also been shown that a considerable amount of the ice which is cut and stored for summer use is taken from water which is more or less contaminated, this being especially the case with the ice cut on the surface of streams or rivers into which the sewage of large towns or cities is discharged and with the ice taken from certain large ponds or small lakes the water of which is contaminated either by municipal sewage or by washings of manure, etc., from the immediately surrounding water-shed.

This is, therefore, pre-eminently the time when health officials and sanitary inspectors, both State and municipal, should be observing the localities and conditions under which the ice crop is being harvested. It is true that they have little or no legal power in the matter, and that if they discover that ice from doubtful or dangerous localities is being stored they cannot prevent it by process of law, but it is equally true that in matters of this kind publicity is one of the best means of prevention, and that they have really great power in their hands if they publish the results of their inspections and observations.

Those who store ice of doubtful purity will usually claim that it is to be used only for packing purposes or in cold store-rooms, where it will not be allowed to come in contact with articles of food or drink. This distinction appears to be recognized in some laws on the subject; for instance, we notice the following item in a Milwaukee paper:

"The Health Inspectors will begin to morrow making an inspection of the ice-houses in the city. It is intended to rigidly enforce the new law requiring the separate storage of river-ice and that intended for family use."

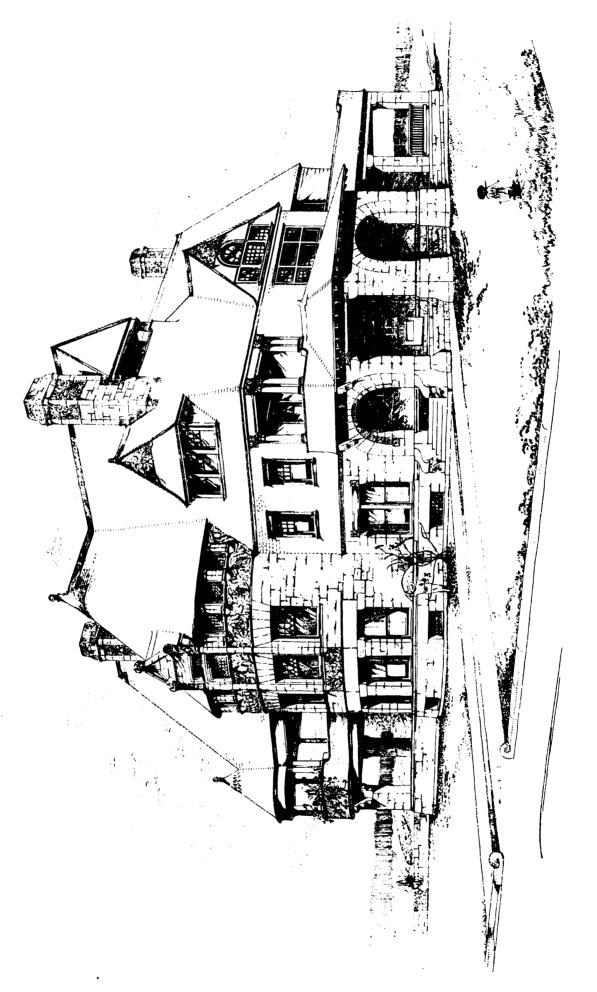
This sounds well, but we are skeptical as to the value of the results which will be produced by enforcing separate storage of impure ice, for the simple reason that it will be so easy next summer to mix this impure and cheaper product with that which has been more carefully selected. The rule which should be observed is a simple one. Ice should not be stored from any water or any locality which would not be accepted as a satisfactory source of water-supply for a town or city. For example, ice should not be cut from the Hudson River below Albany at a point so near any city or its sewer outlets that this point would be considered a dangerous one for the location of the intake of the city's watersupply. Ice in summer in this country is no longer a luxury of the rich, but a necessity for all classes, and the State Board of Health can probably find no more promising field of usefulness than the collection now of some definite and positive information as to the source and quality of the ice crop which is just being harvested.





Alteration on Beacon St. Boston Mass.

Sketched for the Engineering and Building Record. Little Archt.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

RESIDENCE OF G. R. HOWARD, ESQ., BUFFALO, N. Y.

J. L. BILSBEE, ARCHITECT.

LARGE ENGINEERING PROJECTS FOR NEW YORK.

It is stated in the New York Evening Post that a bill has been introduced in the Legislature incorporating the New York and New Jersey Bridge Company; capital, \$10,000,000. The directors are empowered to lease the bridge to any railroad corporation, or to consolidate with other corporations. George S. Field, William Libbey, and George Hoadley, of New York, are named as commissioners to locate the bridge, its approaches, etc. It is stated that the bridge shall be 135 feet above high water, plans to be approved by an engineer-commissioner to be appointed by the Governor.

. Application has also been made to the Board of Aldermen of this city for permission to construct and operate a system of railroad tunnels to connect with tunnels under the East and North Rivers with New Jersey and Long Island respectively. The names of those mentioned in the daily papers as being interested in this movement are: Walter S. Gurnee, Augustus C. Gurnee, Thomas Rutter, Frank K. Hain, Aqueduct Commissioner Oliver W. Barnes, General H. S. Huidekofer, of Philadelphia; Malcolm W. Niven, Everett P. Wheeler, Henry S. White, Colonel Robert Townsend, E. Platt Stratton, George R. Sheldon, and General Roy Stone.

OHIO STATE SANITARY ASSOCIATION.

THE fifth annual meeting of this association will be held at Columbus, O., on February 9 and 10. E. T. Nelson, Ph. D., of Delaware, President, and R. Harvey Reed, of Mansfield, O., Secretary. Among the papers promised we note the following:

"Santtation in Architecture," by D. L. Stine, Esq., architect,

Toledo.
"Cremation as a Sanitary and Economic Measure," by Lew Slus-

Children's Homes and Orphan Asylums," by F. H. Darby, M. D., Secretary Board of Charitable and Correctional Institutio

Morrow.

"Hygiene of the School Room," by Dr. F. C. Larimore, men

"The Necessity of Uniform Means of Reporting to Health Departments," by W. J. Scott, M. D., Professor of Clinical Medicine, Cleveland.

Village Boards of Health," by Austin Hutt, M. D., Waverly. Boards of Health and their Relation and Duties to the Public,"

by J. A. Martin, M. D., Findlay.

The Duty of the Public to Sanitary Science," by G. A. Collamore, M. D., Health Officer, Toledo.

House Drainage and Sewer Connections," by William Owens,

M. D., Cincinnati. The Ventilation of Sewers," by John McCurdy, M. D., member

Board of Health, Youngstown.

The Heating and Ventilation of Passenger Coaches," by R.

Harvey Reed, M. D., Mansfield. On Some Points in the Examination of Air," by Curtis C.

Howard, M. Sc., Professor of Chemistry, Starling Medical College,

'Pure Air Within Doors and How to Obtain It," by Prof. P. W. Search, Superintendent of Schools, Sidney

How Far Has the Science of Ventilation Advanced?" by Isaac D. Smead, Esq , Toledo.

"The Water-Supply of Toledo," by Daniel Segur, Esq., Secretary Toledo Water-Works, Toledo.

"The Germ Theory the Correct One for the Contagious, Endemic, and Epidemic Diseases," by A. G. Longfellow, M. D., Fostoria.

"The Necessity for Attention to Mental Hygiene in our Public Schools," by John C. McClung, M. D., Mayor of Leipsic. The headquarters of the association will be at Hotel LONDON CORRESPONDENCE.

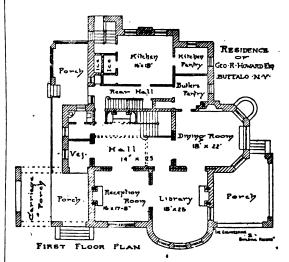
A NEW electric tramcar, destined for the service of the Australasian Electric Tramway Company, has recently been tried on a branch of the Wolverhampton Tramway Company, and has given satisfaction to the Electrical Engineers, Messrs. Elwell & Parker, of Wolverhampton. Secondary batteries, situated under the seats, and easily removable for recharging or other purposes, are employed. The working capacity of the accumulators is given as seven hours, and during the trial the speed attained was fifteen miles per hour on a level road, the car being also taken up a short gradient of 1-15 without difficulty. The motor is geared direct to the axles, and runs at the speed of 300 revolutions. Switches are at each end of the car.

THE destruction of the Grand Theatre at Islington by fire offers comment for those interested in fire-proof construction. The theatre was erected in 1883 (after destruction by fire the previous year), and the most non-inflammable materials known to the architect, Mr. Frank Matcham, were employed. The floors, staircases, and walls were all composed of concrete; the wall dividing the stage from the auditorium was of the same material, about three feet thick. The interior of the theatre, about 120x80 feet, is burned out and the roof off, but the interior architectural lines are traceable, as the concrete walls stand, although divested of all ornament; a small portion, four or five courses, and the coping, almost red hot, of the rear wall was the only portion that fell.

OUR ARCHITECTURAL ILLUSTRATIONS.

RESIDENCE OF G. R. HOWARD, ESO.

Our special illustration this week is the residence of Mr. G. R. Howard, Esq., at Buffalo, N. Y. It is of



brick and terra-cotta, with Akron tile roof and on portion of second story; hard wood interior finish. The architect was J. L. Silsbee, of Chicago.

ALTERATION OF HOUSE ON BEACON STREET, BOSTON, MASS. - ARTHUR LITTLE. ARCHITECT.

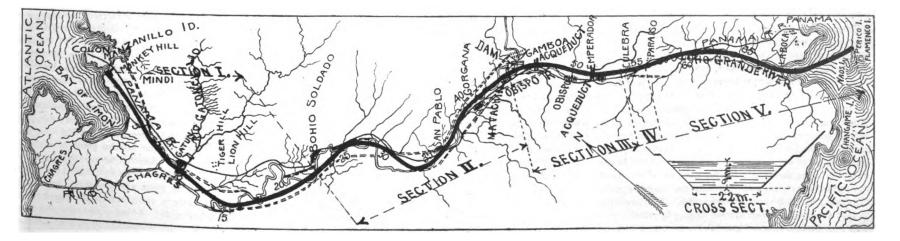
THE PANAMA CANAL IN 1887. BY LIEUTENANT C. C. ROGERS, U. S. N.*

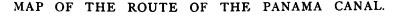
DURING the months of March and April of last year the U. S. Steamer "Galena" lay at Aspinwall, having arrived there from a cruise through the Windward Islands and along the northern coast of South America. On the first of March, five days before our anchorage in Aspinwall, M. Charles de Lesseps, accompanied by M. Romaine, his secretary, M. Cottu, Administrator of the Canal, and other officials from the general office of the company in Paris, had reached the same port by steamer from France, and with M. Jacquier, the Director-General of the works, were occupying the handsome residence in the French quarter of Aspinwall that is usually assigned to the president of the company during his visits to the Isthmus. Their object was to inspect the canal and to arrange with the contractors for the future progress of the works. On the 9th I called on M. de Lesseps and the director-general and requested permission to visit the canal and authority to obtain from the officials full information concerning their respective fields of work. My reception at the hands of both these gentlemen was most cordial and pleasing, and was fully appreciated by me as an extension of hospitality and civilities to an officer of the United States Navy: it was such, too, as made me feel that my request could be stated frankly and would meet with favorable consideration. M. de Lesseps assented readily to my request, assuring me that all the information wished for would be furnished in full, that there was nothing to conceal, and that it was the wish of the canal company that the exact condition of the works and their prospects of completion should be known; he also invited me to become his guest and to accompany him during his tour of inspection. M. de Lesseps had inspected already the 17k. of canal open to water and was to resume the inspection the next day. I accordingly joined him at eight o'clock on the morning of the 10th, and proceeded with him by special train to Bohio Soldado, reserving my visit' to the sections of Colon and Gatun for a later date. The inspection thus begun lasted nearly three weeks, from two to three days being spent upon each section of the works. I thus saw every foot of the canal and of the auxiliary works, including the dam at Gamboa and the channels that are to deflect the Chagres and Rio Grande Rivers from the line of the great highway. Opportunity was also afforded me of seeing all the machinery and the methods of excavation, of inspecting the hospitals and the barracks for workmen, of studying the systems of administration and accounts, and, in short, of inquiring into all matters of organization, execution, and government.

The Panama Canal will extend from the entrance at Colon to the Isle of Naos on the Pacific side and will be 74k. long; its width at the surface will be 40m. and at the bottom 22m.; its depth will be 9m. Its excavation is entrusted to five wealthy contracting firms, each of which has charge of a division. The first division comprises the sections of Colon, Gatun, and Bohio Soldado, and is 26.35k. in length; the second is 17.65k. long, and includes

* Abstract of paper read before the annual meeting of the American Society of Civil Engineers, January 18, 1888.

The following abbreviations have been used in the paper : k., for kilometre; m., for metre; cm., for centimetre; mm., for millimetre; ma., for square metre, and ma., for cubic metre. It will be con venient to remember that a metre is about 31/2 feet, a kilometre about 5% of a mile, and a cubic metre about 1.3 cubic yards







the sections of Tavernilla, San Pablo, Gorgona, and Matachin; the third is composed of the sections of Obispo and Emperador, and has a length of 9.6k.; the Culebra section, or fourth division, is the shortest of all, measuring only 3.4k.; while the fifth division, of 17k. length, comprises the sections of Paraiso, Corozal, and La Boca, and terminates at Panama.

As regards the engineering problems involved, the company has established three physical divisions, each with reference to the difficulties that must be overcome. The first is 44k. long, and extends from Colon to the Gamboa hills at Matachin, the difficulty lying in the vicinity of the Chagres River. The second lies between Gamboa and the end of the Culebra and measures 11.8k.; it includes the sections of Obispo, Emperador, and Culebra, where are found the highest summits and the greatest quantity of rock and through which the deepest and most difficult cuts will extend. The third, 18.2k long, extends from the Culebra to the Pacific. Here the Rio Grande must be deflected from its course, and the earth is such as to admit of dredging throughout.

The American Contracting and Dredging Company is charged with the excavations in the first division. This firm has a capital of \$2,000,000. Mr. H. B. Slaven, of New York, is President of the company, and Mr. M. A. Slaven general manager on the Isthmus. Messrs Vignaud, Barbaud, Blanleuil & Co. have the second division; they have built several railways in France and have had some experience in the construction of internal canals. The third division is under the control of the Societé de Travaux Publics et Constructions, which has a capital of \$600,000 and enjoys a reputation in France and Brazil for very successful railway work. The fourth has fallen to Messrs, Artique, Sonderegger & Co., a firm whose members are young, capable, and zealous, and possessed of the energy needed to remove such a barrier as the Culebra. while Messrs, Baratoux, Letellier & Co., known chiefly for their work on French railways and canals, are engaged to open the fifth division to the waters of the Pacific within the next two years. These firms have guaranteed the execution of their respective contracts in nominal securities whose value varies from \$150,000 to \$1,600,000, according to the extent of the work required and the resources of the company undertaking it.

The excavation for 1885 was 8,212,000m³. Before this 10,205,318m³. had been extracted, so that the total excavation at the end of 1885 amounted to 18,417,318m³. January is a dry month in this latitude, and the year 1886 opened fair and gave a prospect of several months that would offer no serious obstacle to good and effective work. The following table contains for each section of the works the excavation for the year expressed in cubic metres:

Colon 1,555,000
Gatun
Bohio-Soldado 482,000
Tavernilla 63,000
San Pablo 388,coo
Gorgona 370,000
Matachin 172,000
Obispc 713,000
Emperador t,008,000
Culebra 608,000
Paraiso 449,000
Corozal 153,000
La Boca 1,211,000
Derivations 1,382,000
Accessory 342,000
Total for 1886

The average monthly excavation for the first half of the year was 1,057,333m³., for the second half 897,166, for the year 977,250. The largest excavation was made in March, 1,097,000m³.; the least, 828,000, was in December. The decrease for the latter half of the year is due to the wet season extending from May to December. The floods of the Chagres reach their greatest height in November, and, although the dry season begins in the next month, yet the labor required to repair the damages caused by the floods is such that this month shows the least amount of excavation. By comparison it will be seen from the table that the cube for the past year is nearly two-thirds of that excavated between the time of opening the canal and the first of January, 1886. The beginning of 1887 showed a total excavation of 30,414,318m³.

But to obtain a clearer idea of the present condition and extent of the works it will be better to consider the canal by divisions.

First Division—The first section of this division is that of Colon, which is 5.84k. long. It begins at Colon with a terre-plein, which protects the entrance of the canal from

the winds and from the action of the waves that would enter otherwise from the Bay of Limon. The site of the terre-plein was occupied formerly by a marsh; it required 236,000m8. of earth to fill the marsh and to raise it to an elevation sufficient to protect the entrance to the canal. The terre-plein is surrounded by a stone sea-wall, and on it stands the town of Christoval Colon, where the offices and quarters of the section employees are found. The present harbor of Colon or Bay of Limon is directly exposed to the sea and to the gales of this region. To avoid the consequent danger and inconvenience, the company decided to make a new harbor which should be called the Port of Colon. It will lie directly south of the terre-plein, and will be formed by Fox River-the channel separating Manzanilla Island from the mainland-coupled with the expansion of the first three kilometres of the canal into a The entrance to the basin will be 800m, wide. The width will decrease gradually to 500m. at the sixhundredth metre of length. This breadth will continue to the second kilometre, whence it will decrease again to the third kilometre, where the normal surface-width of 10m. begins. A curved breakwater of 1,500m, length will prolong the right side of the basin into the bay, and will further protect the port from winds and waves. The distance between the outer extremity of the breakwater and the nearest point of the terre-plein will be 225m., which therefore is the width of the entrance to the canal. This new port will not only afford security to vessels, but will also accommodate a large number of them and will offer every facility of wharfage for loading and unloading cargo. One-half of the first kilometre has been excavated to a width of 225m.; that of the remaining length of basin varies from 80 to 175m., gradually narrowing to 40m. at k. 3, which becomes now the surface-breadth of the canal proper.

The canal is open to water for 16.75k. from Colon, except at the Mindi hills, where a cut of 1,080m. remains to be completed. The greatest depth is 26 feet and the least 7, the average being about 16 feet. The Mindi cut has been chiefly through rock, and the delay in opening it to water is due to the wish to complete the excavation of rocks before letting in the water so that the work of excavation may not be impeded thereby. The excavation ex tends now to a depth of 3m. below the sea-level throughout nearly the entire length of the cut. The Mindi hills are then the only obstacle in the way of passing by water to kilometre 16.750, which may be styled the present head of navigation in the canal. I traveled from Colon to Mindi in one of the company's launches, which the Director-General had kindly put at my disposal. Crossing the Mindi cut, I went on board another launch, visited Gatun, deflections Nos. 1 and 2 of the Chagres River, and returning to the canal steamed as far as kilometre 16.750, where dredges were continuing the work of excavation. The Gatuncillo, Guarapa, and Vino-Tinto Rivers that formerly crossed the line of the canal are now cut off by a barrage in each and flow through deflection No. 2 of the Chagres. In the two sections of Colon and Gatun, eleven dredges were at work-four are of 60 horse-power and one of 180 horse-power, all of which were brought from Europe. The remaining seven are American dredges of 240 horsepower. Each can excavate 6,000m8, in 24 hours, though their highest yield so far has not exceeded 5,000m8. Their average excavation is 3,000m8, per day; this falling off from the maximum capacity is due to delays that cannot be overcome. Three hours in the middle of the day; for example, are lost, because the laborers will not work in the heat of that period, fearing its effects. Repairs to machinery, rains, stoppage at night or other causes of suspension have reduced the average cube to the stated amount. The present bed from k.17 to the end of the division has an elevation varying from 4 to 10m. above the sea, except near k.24, where there is a hill of 54m. original height, but which has been reduced to the levels of 12, 20, and 28m.

Second Division.—The crossings of the Chagres River form both the upper and the lower limits of this division, which it crosses 17 times in its length of about 17k. Between the k.32 and k.35 but little work has been done, but the general level for more than 10k. is 12m. above the sea. Throughout the remainder it varies from 8 to 12m., except in one hill of 25m. height, and a comparatively sudden rise to the same elevation at the end of the division. Dry-earth excavators are used in this soil. They are moved on parallel tracks by an engine of 8 to 10 horsepower, and their buckets empty the earth into cars on an adjacent track. Every facility for dredging is presented

here, not only by the nature of the soil, but by the Chagres River also, the depth of which is such that dredges can be put at every crossing. The excavation of the canal from Colon to k.44 at Matachin is thus comparatively easy. The problem throughout this length is the deflection of the Chagres, and the canal officials claim that it is solved. But until the deflections of this river are made and shown to be a success, all work in the second division must be delayed very much by the annual overflow.

Third Division .- Entering this division, the bed is on an elevation of 15m. above the sea as sar as Gamboa Hill, where 40,000m8, remain for extraction before the same level is reached. Five steam loading cranes are found here, each with a lifting capacity of four tons. The rocks are lifted by them into cars, which, when loaded are removed by an engine. Here, too, is the site of the great explosion of last year, when M. Ferdinand de Lesseps visited the works. The charge used was 2,500 kilos of dynamite and 1,250 of powder, which on exploding blew out 30,000m8. of material. A little further on is the famous Corrosita, still 45m. above the water. But the remarkable feature of this division is the great barrage or dam of the Chagres at Gamboa. From the canal bed at k.45 the river extends in a north-easterly direction past the villages of Gamboa and Cruces and between the ridges known as Cerro-Barucco on one side and the Cerro Obispo on the other. The central line of the dam will cross the Chagres at a distance of 500m. from the axis of the canal, The length of the dam at the base will be 300m., and the height of its crest will be 35m. It will contain 10,000,000m2. of material. The geology of the Gamboa district has been studied during the past year, and it has been found that the weight of the dam when complete will be sustained by the ground ceneath without the need of piling or other artificial support. The geography also is known. and no difficulty or expense, aside from the dam, will be involved for the successful formation of a lake to contain 3,000,000,000m8, of water, or three times the accumulation of water during the worst rainy season. Nature has furnished the other walls of the reservoir in the hills on each side extending up the Chagres and in the natural ascent and configuration of the valley towards Cruces. This lake will be discharged through a deflection of the Chagres, which will meet the river again in the bend north of k.44 and about 700m. from the axis of the canal. The deflection will be 1,200m. long and its capacity such as to drain the lake without causing an overflow in the lower course of the Chagres; but if, from wash or other cause, it should widen and permit a larger escape of water, its width can be diminished by filling in at the sides. It will thus be seen that the administration has abandoned its former plan of an elevation of 63m. for the dam, and that it has also given up the construction of a tunnel. The highest floods are reached between the 20th of

November and 5th of December, when the water rises to 8m. above the ordinary level. During the rest of the year the highest rise does not exceed 4m. In the valley of the Chagres the annual rainfall is 3m. A fall of 165mm occurred in one day of November, 1882. The usual discharge of the Chagres during the dry season is only 14m² per second; in the wet season it 134m³ on an average, and 666m² during the annual floods, which outflow ordinarily lasts not more than forty-eight hours. In 1879 there were extraordinary floods in the river, and the discharge was 1,930m³ per second for six days.

A railway has been laid from the terraces of the Corrosita to the terminus of the Gamboa dam at Cerro Obispo. and a bridge is now building across the site of the dam. The work of constructing the dam will begin as soon as the bridge is finished, when the trains will run out on the bridge and discharge into the valley below their load of earth and rock excavated from the Corrosita. The construction of the dam is much simpler than at first contemplated. The bridge across the valley is temporary, and the sections of Obispo and Emperador contain more than 18,000,000m8. of material, the nearest point of which to the dam is 800m. only. Another interesting feature of this division is the building of two aqueducts near Emperador to carry the water from the mountain streams on the northern and eastern sides across the canal to the Obispo on the other side. These aqueducts will be at the present levels of these streams, and vessels will pass under them. The bed of the canal rises from a level of 30m. near Gamboa to 55m. at the end of the division.

Fourth Division.—The level of the first 600m. is now 51m. above the sea, but the deep cut of the Culebra that follows has an elevation of 78m., except a small portion

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7m. higher, which is being reduced to the same level. A better idea of work done here is obtained by remembering that the original elevation at this point in the axis was 108m., on the right side 140m., and on the left 120m. The sides have a slope of 45 degrees, and the width of the cut at the top is about 300m. The plant of this section is sufficient to do excellent work if properly utilized. There are available for this section 26 excavators, and 15 more are to be mounted; 42 engines, drawing 2,000 cars, are at hand to carry off the material as it is excavated over a network of railways. These tracks are carried around the sides of the Culebra and even prolonged over temporary trestle-work from 100 to 300m. long, over which the earth is precipitated to the hillside below. Two thousand workmen engaged with hand cars. Decauville cars, excavators, and loaded trains present a very animated scene.

A serious question in the Culebra is the accumulation of sediment and material resulting from wash, landslides, and fissures. In 1886, 78,000m8. of earth were washed or fell into the canal; and, according to the rate of excavation for 1886, it must have been the work of six weeks to remove it. This trouble arises chiefly from the slope on the left or northern side of the cut. On the right side the hill is formed of dolerite and sand, and no wash or slide comes from it. But the left side so far consists of strata of clay covered by a mixture of sand, alluvium, and conglomerate. During the rainy season this surface deposit becomes saturated with water, and the increased weight, coupled with the incline in the strata, causes the deposit to slip over the smooth surface of the clay into the canal bed. The clayin turn dries and contracts during the dry season, fissures result, and hence another source of landslides; and the natural wash of the sides by the heavy rains, sometimes torrential in character, is a third cause of deposit in the bed of the canal.

Worse still, the earth on this side has an annual movement of 30 to 45cm. toward the axis of the canal. The contractors acknowledge this to be a serious difficulty and one for which they have not found the remedy. But I am not inclined now to regard it as necessarily endangering the work, because the removal of so large a quantity of material from the sides alters the conditions of support. and, as the canal engineers say, it must change to some extent the position of the centre of gravity of the mass. And it seems natural that in such material a movement or settling would occur in accommodating itself to the new order of things-i. e., in regaining its equilibrium. Hence, I think, the company can view this without alarm. It is thought by the contractors that a bed of rock will be found at lower depths. We leave now the Atlantic slope, and the streams turn toward the Pacific as we enter the Fifth Division.

The soil in the upper portion is largely of clay and when wet its excavation is difficult. The level gradually decreases from 28m. next to the Culebra to 1.8m. at the Boca, the head of which is 6k. from the end of the canal. The average depth of this length is 5.2m., though for 11/2k. it reaches the full depth of 9m. in the axis at low tide. Ten dredges are now at work in this distance, each of which can excavate 2,000m8. per day. The Pacific terminus of the canal is near the isles of Naos and of Perico, whose anchorage forms the real harbor of Panama. The mean level of the Atlantic and Pacific is, of course, the same; but at Colon the highest tides do not exceed 58cm., while at Panama ordinary high tides reach 4m., and spring tides even 6m. To enable vessels to pass through at all stages of tide in the Pacific the depth of the canal for 15k. from Panama will be om. at low tide. The question as to the effect of this difference of tide level on the canal was referred by the company to the French Academy of Sciences. This body replied that it will not be such as to necessitate a lock. The Director-General, while not opposing the view of the Academy, inclines to the belief that any answer to this question must be based on theory at present; that as the canal is excavated the effect must be watched, and upon the practical knowledge thus obtained the final decision as to a lock or tidal gate must rest. The company has the plans for a tidal gate at Panama which will be built if needed.

Deflections of Chagres and Rio Grande Rivers.—
The canal is crossed by the Chagres twenty-eight times between Gamboa and Colon, and thirteen times by the Rio Grande between the Culebra and Panama. To prevent these streams from entering the canal, and to avoid the consequent dangers of current and overflow that would otherwise follow, deflections are cut in such a way as to

carry the waters of the rivers to the sea in beds on each side of the canal. These channels are known technically as the deflections of the Upper and Lower Chagres and of the Rio Grande. The former are the most important, as they are intended to solve the problem of the Chagres by drawing off the waters of the great reservoir at Gamboa and carrying these to the sea without overflow in the lower course. Beginning at the reservoir they extend across country from bend to bend, thus deflecting the river in a course nearly parallel to the canal, and transporting the waters by way of Monkey Hill, empty them into the Boca Grande, the arm of the sea east of Manzanilla Island, on which Colon is built. The aqueducts near Emperador, which will transport the waters from the north-eastern side of the canal across it to the present bed of the Obispo, prevent the need of deflections on the left side to carry away the latter stream. Conveying these waters, this stream will empty through its present mouth into what will then be the old bed of the Chapres, whence they will be transported by a series of deflections to the present channel of the Lower Chagres, which will discharge them into the sea through its mouth at Fort Lorenzo. The deflection of the Lower Chagres is really that of all the tributaries that enter the present stream on its lest bank, the most important of which are the Obispo, Arena, and Trinidad.

The first deflection of the Rio Grande will send its waters into the Quebrada Mallejar, whence they will pass by three derivations into the Boca.

The total length of the derivations will be 64k. Yet, the total excavation amounts to only 9.940,000m8. Their dimensions will depend upon the nature of the soil and the height of the ground. Lying as they do in valleys where feasible, the soil is alluvial and easy of excavation. Already 46 per cent. of the excavations have been made, leaving 54 per cent. to be done. The dredges advance at the rate of 25m. a day. Some of the derivations will be 40m. wide and 3m. deep; others 30m. wide and 5m. deep. Erosion will widen and deepen them to still larger dimensions. So far but one difficulty has been met in excavating the deflections. Occasionally an underground stream is met. which has an undermining action, and since the excavated material is thrown upon the banks of the deflection to give them all the height possible, the weight in some cases has been found too great where these streams occur and the banks have broken. So far repairs have been made-the engineers claim-effectively, and I see no reason to dispute their assertion.

Each section has its machine-shops and storehouses, which are of the usual type of frame buildings with corrugated iron roofs. The principal ones are at Colon, Matachin, and Panama. At the beginning of this year these workshops, with the hospitals, residences for officials. and barracks for laborers, if placed side by side, would have covered an area of 81.3 acres. The houses stand upon hills, as a rule, and near the line of the Panama Rail. way. They are frame buildings, whose sills rest on masonry supports; the roofs are of corrugated galvanized iron. They are clean, well-ventilated, and admirably suited to the climate of the Isthmus. They are rented to the contractors for ten per cent. of their value. Workmen quartered free of charge must pay for their own board. The canteens or boarding-houses are kept by Chinamen, as a rule, who have gained the confidence of the negroes, and who board them at rates that are reasonable for the Isthmus. The negroes and whites have separate barracks. I quite agree with Lieutenant Kimball, who says: These barracks seem to be well calculated for the purpose for which they are intended and are as cheap as anything that could meet the requirements of healthy housing in a climate like that of the 1sthmus. The native huts have proved very unhealthy and expensive, requiring constant repairs to the thatch, which, although a cooler roof than the corrugated iron, was found to be a fertile source of sickness from the decaying vegetable matter, as well as being a harbor for insects." The officers' and quarters of the officials and company employees are capacious and comfortable. And here I agree again with Lieutenant Kimball, who, on remarking that these have been criticized as too expensive, adds, that when it is considered that the death-rate would be larger yet, were not a great deal of attention paid to sanitary conditions and comforts, and that these establishments would be needed after the opening of the canal, it would be a poor economy to curtail the expenses in this direction within the limit of proper requirement.

In 1881 I crossed the Isthmus before a foot of soil had

been excavated from the canal. The only signs of habitation were a few rough huts at the railway stations; the whole country was in reality a thickly-matted jungle. To-day thousands of acres are cleared, and so great is the installation of the company that the canal and railway seem to lie in a populous and prosperous district. Indeed, the passenger from Matachin to Culebra is reminded by the canal property rather of one continuous settlement than of several railway stations. There are 185 kilometres of broad-gauge track and 116 of narrow-gauge on the line of the canal.

Organization.—The Director-General of the work is at the same time the head of the administration on the Isthmus. There are six bureaus, charged respectively with the correspondence, designs, finance, supplies, workshops, and transport by water. The "employees" are men who are in the service of the company, and by this term are distinguished from the workmen in the service of the contractors. Fixed employees are permanent receive a regular salary, regular leaves with pay and expense of travel, and a compensation in case of discharge. Temporary employees can be discharged at any time without extra compensation and are entitled to no unusual privileges from the company. There is a total torce of 926 employees and clerks.

When it is remembered that the work of each division is let to contractors, it seems odd that such a large force should be retained by the company itself, and one regards it naturally as unnecessarily large; the canal company so regards it. and I learned that steps are being taken to reduce the force very much-probably to nearly half the present number. The contractors are responsible for the excavation of each division and must carry out the plans submitted to them by the company. The technical bureaux of design or other work do not fall therefore within the province of the contractor. The accounts of the contractor's employees are really kept by the canal company's agents and such employees are paid by the paymasters of the company. In other words, the contractors are merely the agents of the company to excavate the canal and construct it in its entirety, while the administration to the smallest detail is in the hands of the company.

The pay of excavators is \$1.50 per day in Colombian silver, worth sixty per cent. of our money; mechanics receive a pay corresponding to the character of work required, which in some cases is \$5 to \$6 per day. At the time of my visit there were 926 employees in the service of the company, and 10,640 workmen employed by the contractors. The total force was thus 11,566 men. The laborers are chiefly negroes from Jamaica or other West India islands, with a few from Louisiana and other Southern States, who have gone to Colon in coasting vessels and have been attracted by the wages of \$1.50 per day in Colombian coin. Time contracts are unknown. The Government officials in the islands, particularly in Jamaica, discourage negro emigration to the Isthmus, and changes are arising constantly from sickness. dissipation, return home, or fear of revolution. Many are prompted to leave by the exorbitant rates of the Isthmus, by a lack of guaranteed hospital attendance, by fear of the climate, or by sufficient accumulation of money. The worst characteristic of the Jamaica negro is his indolence : he is a shiftless creature, who can subsist on little, and whose laziness prompts him to hoard his earnings for a few days and live upon them in idleness till exhausted. He gambles frequently, and would be healthier if he avoided the petty banker, who charges him usurious rates of exchange, and the saloons where brandy bought probably for twenty five cents a quart is sold to him for one dollar a bottle. This miserable liquor has probably caused indirectly as much yellow fever as the climate itself; in fact, from all I could learn, it contributes largely to what is called deadliness of the climate.

On Saturday the laborers are paid. Sunday is spent in dissipation or pleasure, Monday in recuperation, and it is not till Tuesday that a full force is at work, so that the number of working days in a month seldom exceeds 20 or 22. Twenty thousand laborers are wanted, and as the West Indies do not furnish them the company is trying to solve the difficult problem of labor in the populations of Western Africe 21. I Southern China. About 31 o Kroomen and as many Chi...amen recently brought out have shown themselves good workmen, and much is expected from the former especially, who come out acclimated, are temperate, large, able-bodied, and zealous workers.

The principal hospitals are at Colon and Panama, but physicians are assigned also to each section of the works.

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There is, too, a sanitarium on Taboga, an island fourteen miles from Panama. The entire medical staff consists of 30 physicians and 50 apothecaries. It must be increased and other hospitals provided if additions are made to the force of laborers. The hospital service has been much criticised, and it has been charged that contractors discharge the sick, who die for lack of medical attendance. During my stay of six weeks on the Isthmus I saw nothing to confirm such statement. On the contrary, I saw cases of marked kindness and care on the part of contractors toward their sick workmen. Such a thing as discharge and neglect are possible under the system, but I doubt its occurrence very much. The hospital records show a death-rate of seven per cent., but this does not include those who, on account of illness or disease contracted here, have left and died elsewhere. From conversation with many intelligent men on the line of works and in Panama and Colon, I infer that the death-rate from all causes is not more than 14 per cent. at the highest estimate. The highest percentage of deaths from any single month was in June, 1885, at the Colon Hospital, where 36 out of 210 patients died, the per cent. being 17. The least is one per cent., in December, 1882. But the recorded average since the beginning of the work is seven

Double service is required of the medical staff, for it is compelled to serve both in the hospitals and along the line of the canal. Seventeen surgeons, assisted by apothecaries and several nurses in each case, are distributed along the line in the thirteen sections into which the works are divided. Their special duty is to attend the sick or wounded within their respective sections, to treat at home those whom they think can be kept there, and to send to the hospitals at Panama and Colon those who are in need of the care, treatment, and attention of such institutions. The Central Hospital of Panama consists of 16 pavilions separate from each other. Each is surrounded by a wide gallery, thoroughly sheltered from the rays of the sun. The pavilion where contagious diseases are treated stands apart from the others. These buildings cover a length of 1k. The cost of this hospital was \$832,724.97. Any person in the employ of the canal company or of the contractors is admitted upon a physician's certificate. The average number admitted to the hospital and discharged from it every month is 500. This number is composed of Europeans, Colombians, negroes, Chinese, and those who from wounds or other injury require surgical treatment alone. Eight experienced practitioners assisted by clinical clerks and students constitute the hospital staff. Severaj sisters of the order of St. Vincent de Paul assist the apothecaries in carrying out the orders of the physicians and in nursing the sick. The physicians are required to visit the patients at least twice a day.

The hospital at Aspinwall is a wooden structure near the seashore. It includes a central pavilion reserved for the sick and wounded of the company, contractors, and Panama Railway, of another for women, and of a third for strangers, sailors especially. This hospital is under the care of the Sisters of St. Vincent de Paul, and will accommodate 100 patients.

The sanitarium at Taboga was, until 1886 a building set apart on the island of Taboga for convalescents and agents of the company who needed recuperation from climatic effect or other cause of weakness. The building used was rented and proved too small for the applicants. The num ber of patients average 60 per week, and they now occupy a new building on the same island, the property of the company. One-twentieth of the number of beds are reserved weekly for the officials of the canal, who are admitted in the order of their application and are allowed to remain from Saturday until the following Monday only, unless a further stay be necessary for recovery.

On the 1st of January, 1886, one notices on the list of material 4 steam launches, 116 lighters, 29 tugs, 48 steam-cranes, 40 dredges, 81 excavators, with 30 ordered for the Culebra, 6,268 ordinary cars, 6,723 Decauville wagons, 88 centrifugal pumps, and 170 locomotives, besides a large plant of smaller material needed for such an enterprise. During the past year this larger material was increased by 3 tugs, 6 lighters, 23 dredges, 44 steamcranes, 60 excavators, 2,010 cars, 38 locomotives, 260 steam-cranes for loading, and 290 Decauville cars. The Société de Travaux Publics et Constructions are also credited with 1,000 steam-drills. I inquired specially about this, and was told that this number is really owned by the society. At the Corrosita, and in other parts of the society's sections, I noticed that they were used very liberally,

but their introduction is not as general as it could well be. At the present time there is undoubtedly a fine plant. The machine shops are well equipped, and capable of meeting the requirements of the enterprise. The American excavators are better in rocky ground than the French chain-of-bucket machines, which are best adapted to soft earth. The buckets of the latter have a greater capacity than those of the American machine; but our excavators are preferred by some of the contractors on account of their superiority in stony ground. The small cars are used too much. I noticed many hundreds of Decauville cars where excavators and trains of large cars could have been used to far greater advantage. As already stated to you, the second division is crossed seventeen times by the Chagres, and the delay in putting dredges to work on this section is to me inexplicable. Although preparations were making for it in two or three places, yet there was not a dredge actually at work. This and the last divisions are both easy of excavation, yet the work done in them is n.uch less in proportion than elsewhere.

Up to now the Decauville dumping hand-cars have been used in preference to any others for dry-earth work, for neither the French or American excavators have proved satisfactory, but in water the dredges have operated with good results. The Decauville hand-car consists of only two pieces, the cast-iron truck with four wheels, and the box of iron plates secured with rivets, which is of the capacity of half a cubic metre, and requires only two men to work it. These little wagons have been more useful than the large ones, which, owing to their great weight, have not been well suited to the work, as they need too many hands to move them. Half of the cube extracted up to date has been the work of this ingenious apparatus.

Each dredge has seven steam-engines, which develop together a horse-power of 300. Two of these engines move the bucket chain; two others of 30 horse-power move the hull of dredge, and two others elevate and depress the bucket beam. The seventh engine is employed in working the stump-extractor. Then two steam-pumps of 40 horse-power supply about 40,000 gallons of water per hour, which is thrown upon the buckets when they are at the top of the chain, and serves to wash out their contents. This, however, requires only one pump when the earth or mud loosens from the buckets easily and passes through the discharge-pipe.

Three large tubular boilers, fed by a condenser, furnish the steam needed for all these operations. Each bucket is lifted to a height of 45 feet above the line of flotation, and there emptied into a tube of three feet diameter and 150 feet length. In working, the dredges are 15m. from the bank of the canal. The buckets contain .79 of a cubic metre. They move at the rate of 16 buckets per minute, producing 7.854m³. in ten hours of work. The dredges at work on the Atlantic side have given the best results. Those on the Pacific side have met with mishaps and have not worked so well. What is wanting is not machinery, but the laborers to utilize it.*

The resources of the company have consisted in the original 600,000 shares of 500 francs each, or 300,000,000 francs, and in four issues of bonds as follows:

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1. 250,000 bonds of 500 francs, 5 %, realizing 437½ francs each.
2. 600,000 " 500 " 3 %, " 285 "
3. 387.387 " 500 " 4 %, " 333 "
4. 458,802 " 1,000 " " 450 "
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In August of 1887 another loan was made—500,000 bonds of 1,000 francs each, payable in 48 years; have sold 258,887 at 440 francseach, thus producing 113.910,281 francs. The company has thus received the sum of 1,030.943,180 francs. On the first of September last the company had in cash 213,910,280 francs; subtracting this sum from the former the company had expended on that date 818,032,900 francs.

The first three issues are redeemable in 75 years, under a system of semi-annual drawings, by which a given number are redeemed yearly. The last issue is redeemable at 1,000 francs in 42 years, a given number being redeemed every two months by drawings.

The total sum realized on the first of last March was 936,607,809 francs, or \$179.771,190, the amount spent on that date amounting to \$134,084,729. Since then a new loan has been raised; in other words, the obligations of the company, with expenses in the meanwhile, have con-

sumed the difference between these sums, and the actual expense so far has been nearly 180 millions of dollars.

Of this sum, one-fifth, 36 millions, may be regarded as the cost of the quarters for officials, barracks for workmen, and the present plant of machinery; 18 millions were paid for the Panama Railway; and the remainder, 125 millions, has been expended in salaries of officials and employees, pay of workmen, and general expenses of administration, repair, and execution.

In 1870 the traffic of the Suez Canal was represented by 435.911 tons of shipping; fifteen years later, in 1885, it had increased nearly twenty-fold, for the tonnage was 8,985,411. The revenue in the same time had increased from 5,159,327 francs at the former to 62,207,439 francs at the latter, or about twelve-fold.

M. Levasseur, Member of the Institute, has estimated that if the canal were opened in 1889 the total tonnage of vessels passing through it would be 7,250,000; and M. Marteau, editor of the Journal du Havre, takes a more hopeful view and estimates it at 9,000,000, as much during the first year of presumed existence as the Suez Canal had after it had been open fifteen years. I cannot accept these estimates for myself, because these gentlemen take the commerce of Western Europe with the Pacific away from the Suez Canal in the short space of twenty-four hours and send every ton of it forthwith through the Panama Canal. I cannot accept it, again, because the great markets of the Southern Mediterranean, of Egypt, and of India, which have so much to do with the commerce of Western Europe, are apparently ignored in these estimates, and the great fact forgotten, that as long as the eternal laws of supply and demand exist, there will be a trade, and a large trade, between Western Europe and the Pacific via the Suez Canal, no matter if a dozen canals are cut across Central America. But granting that 9,000,000 tons, the largest of the estimates, would be the traffic during the first year of presumed existence, let us examine the results. It is said that fifteen francs will be the tariff per ton; the revenue then becomes 135,000,000 francs. Deduct probable expenses of administration and repair, and we have a balance left that would remunerate an investment of about \$240,000,000. Already three fourths of this sum, or \$180,000,000 has been spent, and the result is houses for 15,000 workmen and employees, hos pitals, and an excellent plant of machinery, and 30, or say, to-day, 331/3 per cent. of excavations. I have already shown that quarters, hospitals, and machinery cost only one-fifth of this, and that the 33 1/3 per cent. of excavation has cost in the neighborhood of \$125,000,000. To increase the excavation more machinery must be bought, to lodge additional workmen other barracks must be built, and today there remains fully 663/3 per cent. of material to be excavated. The inference is that for \$240,000,000 the canal cannot be built. Knowing the remaining cube, cost of excavation, and price of labor, with resources at hand, it is a simple matter of mathematical computation to show that the final cost of the canal will not fall short of \$375,000,000. Such an estimate is too detailed for the purposes of a lecture; but to confirm this estimate probably even more forcibly than our mathematical computations would, the canal company itself acknowledges now that the ultimate cost will be 2,000,000,000 francs in cash, which is even more than \$375,000,000 in gold.

In the original Act of Concession on the part of the Colombian Government to the Inter-Oceanic Canal Company it was agreed that the company should have the right to a border of 200m, of land on each side of the canal and to 500,000 hectares, or 1,235,571 acres, of public lands in such part of Colombia as the company should choose, and the titles to such lands were to be surrendered as the work on the canal progressed. The first surrender was of 150,000 hectares at a time when the Colombian Government conceded that one-third of the total work was finished. This land is situated partly near the Chiriqui Lagoon and partly on the Pacific slope along the Tuira River. Besides this the company has acquired 34,653 acres between Colon and Panama. On the 3cth of last December the first grant was increased to 250,000 hectares, the Colombian Government conceding that one-half of the total work necessary for the construction of the canal had been done; so that the company now owns 652,438 acres of land in Colombia, besides a border of 200m. width on each side of the canal. This concession, however, does not mean that the Colombian Government concedes that one-half of the total cube has been extracted, nor that the canal company made any such claim; but that the present excavation plus the installation-which means the present quarters for



^{*} It has been suggested that the quickest and cheapest way to excavate the earth on the high levels would be to wash it down by powerful streams of water under high pressure into the lower portions of the work where the dredgers could conveniently dispose of it

officials and workmen, the hospitals, and the plant of machinery-represents one-half of the total work to be done in order to finish the canal.

Undoubtedly the plant of machinery and the quarters for employees are important factors of the total work required to construct the canal, but few will acknowledge that in an enterprise of this magnitude they represent 20 per cent. of it, and, to my mind, the Colombian Government would be sufficiently liberal in conceding to-day that one-third of the total work has been done.

As regards time of completion, it goes without saying that the rate of excavation must be small in a work of such magnitude until the plant is complete. It is equally true that more work can be done in a given time with a complete installation than with one that is incomplete. Hence it is false reasoning to suppose that if 32,000,000m8, are excavated in five years it will require nearly twelve years to cut out the remaining 73,000,000. That such reasoning is absurd is shown by the excavations of 1886 alone, which were nearly 12,000,000 of cubic metres, at which rate it would require about 61/2 years to complete the excavations. M. Cha:les de Lesseps told me that in two years the canal would be finished from Colon to k.44. and from La Boca to Paraiso, but that, as to the Culebra, he would leave me to form my own conclusions. The rate of this year does not exceed very sensibly that of last year, and it is hardly practicable to suppose the machinery will be increased so rapidly as to show a marked increase in excavation for a year or more yet. Considering the work necessary even after all the excavations are made, and especially that the two great problems, the Chagres and the Culebra, have vet to be solved, it is a fair estimate to say that even if the work be pushed with vigor the canal will not be open in less than six or seven years.

So far as I was able to verify them the statistics given me by the company's officials were correct. Whatever criticism has been given to the public in condemnation of the hospital service, barracks for workmen, and quarters for officials seem to me not founded on reason and uniust. In such a wretched climate and considering future needs, they are decidedly in the line of wisdom and economy. The machinery should be increased still more, a larger force of excavators and dredges should be at work in the second and fifth divisions especially, and larger cars should be used in place of the small Decauvilles. I see no reason why the excavations should not reach 20,000,000 or 22,000,000 a year.

While on the Isthmus I met many residents and foreigners who were not interested in the canal. Its most bitter opponents were our own countrymen, a few Englishmen, or former employees of the company, or contractors who had been discharged or had some other grievance. Many of these opponents were intelligent men who did not hesitate to make most exaggerated statements, showing either utter ignorance or malice. They did not seem to fear an impeachment of their own intelligence by others, so that in general reliable information was to be obtained nowhere except on the line of works; but from all sides, friendly or otherwise, arose the same admissions that the canal presents no insuperable obstacles, that the company has both brains and energy, and that the final completion is merely a question of time and money.

Note.-Between March and September, 1887, the amount excavated was 5.556,000m3. Returns since then are not at hand, but it is fair to presume that the cube extracted since last March will approximate 10,000,000m8, so that the total cube extracted to date is about 42,000,000m2. Senor Armero, agent of the Colombian Government in a report dated September 1, 1887, states that the total excavation will amount to about 168,000,000m8., an estimate exceeding that of the company by 63,000,000m³. It is true that many will refuse to accept the company's figures as correct. But if its estimate be too small, Senor Armero's is equally too large, and personally I incline rather to the belief that the approximate mean of these two estimates, or about 125,000,000m8., will prove to be the real cube. Senor Armero estimates the whole sum yet required as 3,012,495.400 francs, or \$602,639,080. This fabulous sum he believes will be raised, because so many m llions are already sunk in the work, and one-half million holders of stocks and bonds are interested, and the honor of France is at stake. But at the rate of progress so far attained the work cannot be completed, nor can even the temporary canal, with locks, etc. (now proposed by M. de Lesseps), be opened to traffic in 1889 or in 1892, the year in which the concession terminates. M. de Lesseps

now proposes to excavate the 60k. of lowland to the present dimensions and to form of the 14k. of the highest land a reach or lake connecting with the lower reaches on Atlantic and Pacific sides by locks. Dredges will continue the excavation of the reach, and thus the excavation to a sea-level canal will continue along with the passage of traffic and its consequent financial gains.

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	:	Baratoux, Leteiller et Cle		Antigue, Sonderegger & Co Culebra		Societe de Travaux Publics et		& Co	Wignaud, Barbaud, Blanleuil		Treaging Co	American Contracting and	CON MACCORD.	CONTRACTORS
Totals	Total for Division 5	La Boca.	Paraiso	Culebra	Total for Division 3	Obispo	Total for Division 2	(Matachin	Tavernilla	Lotal for Division t	$\overline{}$	Colon	OBC LONG.	Sections
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95,150,000 27,400,000 67,750,000 9,940,000 4,520,000	4,100,000	1,900,000	1,800.000	2,100,000	7.400,000	3,100,000	4,500,000	1,200,000	500,000 1,200,000	9,300,000	2,100,000	1,000,000 5,300.000	Removed.	CUBIC METRES IN CANAL.
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4.520,000	360,000	80,000	180,000		90,000	90,000	604,000	200.000 150,000	100,000	3,470,000	450,000	42C,CO0	Removed	TRES IN D
5,420.000	130,000	20,000	60,000		1,310,000	810,000 500,000	2,750,000	590,000 250 000	1,100,000 810,000	1,230,000	650 000	180,000	Removed Remaining.	CUBIC METRES IN DRF. ECTIONS.

TRANSMISSION OF POWER BETWEEN BODIES MOVING AT DIFFERENT VELOCITIES.

A FEW months ago, there was exhibited, in the society's reading-room, a working model of an application to rail-way working of what the inventor calls "division of the mass." In causing a body, moving at a high velocity, to mass." In causing a body, moving at a high velocity, to communicate motion to another at rest, or moving at a lower velocity, he splits one of them up into parts all the more numerous, and therefore tenuous, as the difference in velocity is greater; and this is accomplished by causing one of the parts to take the form of a brush composed of metal fibres.

In applying this principle to the transmission of motion for driving machinery, a disk, fitted with segmental brushes, is slid laterally along the shaft, so that the fibres come into contact with radial projections on a second disk; and, although the contact is made instantaneously, the action is exerted gradually, owing to the flexibility of the fibres. That is to say, the full power is communicated without

A similar arrangement, but with one of the disks fixed, serves as a brake for arresting motion, and this again without shock but with gradually increasing action. Where space is very much circumscribed, the clutch and the brake may be combined, by fitting a disk with brushes on one side, and projections on the other, so that it may be brought by a lever against a second disk for transmitting motion, and against a third, fixed, for stopping it. Safety appliances for arresting the descent of mine cages, in the event of the rope breaking, have hitherto depended upon the entrance of claws into the guides, or the clipping of the latter, or the wedging of the cage between the guides. A similar arrangement, but with one of the disks fixed

between the guides.

In this application of the system, the guides of the shaft are fitted with corrugated-iron plates, and the sides of the cage with steel brushes. In the normal state of working, the brushes are kept clear of the guides, but, should the rope break a small brush, fitted on a sector, constantly rubbing against the corrugations of the guides, aided by a spring or counterweight, brings the main brushes into contact with the guides by a link arrangement, like that of the parallel ruler, thus arresting the cage, and holding it suspended until the brushes are gradually relaxed, for "braking" the cage slowly down to the next landing.

"braking" the cage slowly down to the next landing. Many attempts have been made to cause a locomotive, running at full speed, to exert such a mechanical action as would set a signal to danger, so as to protect the train from another following in the rear. By fitting the engine with a steel brush, attached to the axle-boxes, so as to preserve a uniform height with respect to the rails, a stationary lever may be gradually moved, so that the signal is set at "danger" without shock. Moreover, by means of another brush in the event of the engine being turned of another brush, in the event of the engine being turned upon the wrong line, a lever may be made to shut off the steam, apply the brakes, blow the whistle, or move an index on a dial, recording a neglect of duty, or may exert these four actions simultaneously.

All the above applications of this principle—"the division of the mass" have been tested experimentally, the last-named by the model above referred to. The clutch arrangement has transmitted six horse-power from a petroleum motor, making 200 revolutions a minute, to a de making 2,000 revolutions, while applications to industrial purposes are now being made, both in this country and in Belgium. The inventor of the system is M. Raymond Snyers, Ingenieur des Mines, du Genie Civil, et des Arts et Manufactures, of the Louvain University - Journal of the Society of Arts.

THE GREAT BEAR VALLEY DAM.

Los Angeles, Cal., December 17, 1887.—One of the disadvantages which tend to obstruct the advancement of many sections of Southern California which have been boomed by land agents and speculators is the lack of water, for without means of irrigation there is no chance tor development. A few days ago I went over to Redlands to take a trip over the mountains on the back of a bucking Mexican broncho to inspect the remarkable bit of engineering work recently completed in the Bear Valley, by which the towns of Redlands and Lugonia receive an unlimited and exhaustless supply of water the year required. unlimited and exhaustless supply of water the year round. The ride is about thirty-two miles over the mountain trail. Leaving the small settlement of Crafton we wind through the Mill Creek Canon, and then climb over the San Bernardino Mountain at an elevation of 5,600 feet above the sea, or 4,100 feet above Redlands. Then we go down and through the Santa Anna Valley and cross the next ridge at an elevation of 7,600 feet. Then we descend 1,200 feet and ride three miles further, when we come to the great Bear Valley Dam, which backs up the Bear Valley Lake, or great reservoir, as it may now be called. One is spellbound when he examines this stupendous piece of work and realizes the labor that it cost. All of the cement and other materials, excepting the granite, which was quarried near by, was carried by teams and pack-mules 100 miles, and each barrel of cement cost \$13 when delivered at the dam. It took a team two weeks to reach the Colton Railroad station, and the engineers and laborers Colton Railroad station, and the engineers and laborers lived in rudely-constructed log huts for six months. From Colton the route was up the Cajou Pass, thence over the Mojave Desert, then through "Lucky" Baldwin's silver mine trail to the end of the dam. The dam is built of big blocks of granite, ranging from a half ton to ten tons in weight, the majority being about four tons weight each. Its base rests upon a solid rock foundation and its present height is about sixty feet, though it may be increased twenty feet without any risk of weakness. It is a curved dam, its length of arc being 300 feet and its radius 345 feet. Its base is twenty feet wide, and from this it slopes to three feet wide at the top. Its average coefficient of safety is twenty-five, and it would stand twenty times ol safety is twenty-five, and it would stand twenty times its present pressure. The engineer was F. E. Brown, a graduate of Yale College and of Yale Scientific School, and one of the largest property owners in the county. The State Engineer of California has pronounced the work not

only efficient, but a remarkable piece of engineering.

The lake or reservoir receives the drainage of 200 square The lake or reservoir receives the drainage of 200 square miles. It covers an area of 4,000 acres, three-fourths of which around the old lake was used as a sheep ranch until purchased by the Bear Valley Company. At the present height of water, fifty-three feet, at the dam there is a supply of nearly 10,000,000,000 gallons, covering an area five miles in length and a half mile in width an average depth of fifteen feet. With the dam at its full contemplated height the lake will hold 40,000,000,000 gallons, and at sixty-five feet 21,000,000,000 gallons. Before the dam was ball this water was allowed to flow in winter torrents to the sea. It is now capable of irrigating 50,000 acres of land in the frostless foothills, once supposed to be beyond the pale of irrigation, and to supply a posed to be beyond the pale of irrigation, and to supply a population of 500.000 for domestic purposes. It at present irrigates the lands included in the towns of Redlands, Lugonia, Craston, and Highlands, and is to be extended to San Bernardino.—Correspondence of N. Y. Tribune.

A THOUSAND HORSE-POWER WATER-WHEEL.

A TURBINE of 1,000 horse power, described in the Chronique Industrielle, December 11, has just been placed in the Terni Steel-Works at Rieter & Co.'s shops at Winterthur, France.

The motor utilizes 560 litres per second of water under

The motor utilizes 500 litres per second of water under a head of 180 m.; the coefficient of efficiency is 0.75.

The turbine is of Schoamburg's design, specially designed for great heads and limited supply. Its internal diameter is 2.8 m; it weighs 4,500 kilos, and makes from 180 to 240 revolutions per minute.

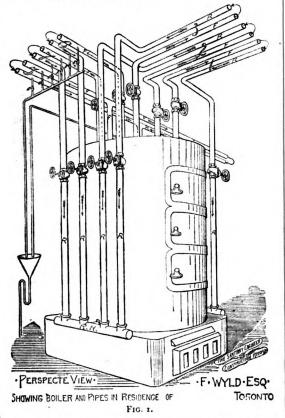
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HOT-WATER HEATING IN THE RESIDENCE OF F. WYLD, ESQ., OF TORONTO, CAN.

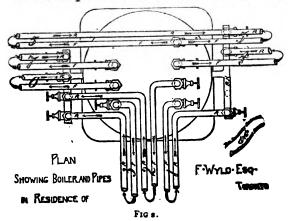
THE accompanying description and illustrations of the heating by hot water of the residence of F. Wyld, Esq., of Toronto, Can., must prove of interest to hot-water engineers and others interested in the warming of houses.

Many residences in Canada are warmed by hot water, and a practice very much in vogue, if not the only one now resorted to, is to run separate circuits of main pipes from the top of the boiler to the principal divisions of the house. This practice seems to have its advantage in the fact that the fitter is much more likely to have nearly uniform results at all parts of the house in the matter of equitable temperatures of the water in the radiators or the coils than he would if he were to run a large main and branch from it to the sections or rising lines.



Really, this separate circuit system is unnecessary if the work is planned by one who has time and ability to consider carefully the conditions and requirements of the different lines and branches of a system, or if one wishes to use a main so very large that there is no question of its ability to carry water hot enough to the remotest end no matter how slow its current may be; but this carries the fitter to the other extreme, and probably will increase the cost -at least for small buildings or residences where a boiler can be placed somewhat central-beyond what separate circuits of 2-inch pipes or thereabouts will come to.

Currents through a branched system unquestionably take the direction of least resistance and will short-circuit



unless planned by an expert; whereas, the separate circuit must circulate to the end, if it circulates at all, and hence the practical man finds it to his advantage to use it.

In this house, as seen by Figs. 1 and 2, the separate system is carried out almost to the extreme. They are all of 2-inch pipe, except where they branch to two heaters, and the return-pipes are the same diameter, as they properly should be, as the shrinkage of volume of the water is so inconsiderable between the flow and the return that no attention should be paid to it.

The circuits are numbered from 1 to 7 inclusive, and may be traced on the plans of basement (Fig. 3), like numbers corresponding to like circuits in all illustrations. Number 1, to the right of Figs. 1 and 2, supplies the lower hall (box) coils of 1-inch pipe of 432 and 330 lineal feet respectively, and the coil in pantry of 96 feet, lineal, of 1-inch pipe. No. 2 supplies the parlor and pantry on the main floor, and then runs to the bath-room on the second floor, and a branch from it goes to the expansion-tank. No. 3

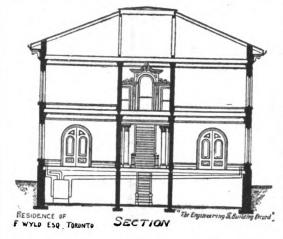


FIG. 4.

goes to the two heaters in the drawing-room, one of 324 feet, lineal, and the other of 288 feet. No. 4 supplies the two library coils of 200 feet, lineal, each; No. 5 the two dining-room coils of 336 feet, lineal, each; No. 6 the indirect coil under main hall of 600 feet of 1-inch pipe; and No. 7 the front hall coil second story, and the coil in the front chamber next to it.

The remaining rooms of the house have no heaters in them, but the owner informed the writer that even in the climate of Toronto they are warm enough to be comfortable at all times when the doors were open, the fire-places drawing the warm air of the halls into them.

The connections to the coils are large-11/2-inch for large coils, 114-inch for medium, and 1-inch for the small one in pantry.

The circuits are treated very much in the way plumbers in New York treat the circuits for domestic supply in their best work. The flow and the return pipes are supplied with valves close to the boiler, as plainly shown in Figs. I and 2. A line of small "draw-out" pipes are placed in the flow and return pipes on the house-side of the stopvalves to allow of the drawing off of the water from a line or circuit. This is plainly shown in Fig. 1, and also the funnel into which they empty. This funnel is trapped in the usual manner to the sewer and the overflow-pipe of the tank is brought into it to prevent a dry trap.

The letter F, for flow, is on the outgoing pipes of the circuit and R on the return-pipes. Arrows also show the direction of the flow of the water in both pipes, so that a little study of the diagram will readily show the relations of one to the other.

The pitch and flow of the pipe is always upward until it reaches the heater, so as to free itself of air at the highest pipe of the coil (the upper header), at which point an air. vent is used. The box-coils are screened and have marble

The total surface in square feet, not including the mains, is a little over 1,500, and the boiler is a No. 36 Gurney, of about 51 square feet of surface of all kindsthat is, fire-box and flue surface-which gives a ratio of boiler surface to radiator surface of I to 20.8

The dotted lines on basement plan show the old furnace and furnace pipes. With this arrangement 32 tons of coal used to be burned in a winter without sufficient heat. The consumption of coal with the hot-water apparatus is 19 tons.

The apparatus was put in by Messrs. Cruickshank Brothers, of Toronto, and the architects of the building were Messrs. Smith & Gemmell also of Toronto.

CINCINNATI MASTER PLUMBERS' ASSOCIA-TION.

THE annual meeting of the Master Plumbers' Association was held Monday afternoon, January 16, at Lancet Hall, President Carlisle in the chair, and a full attendance on the part of members.

The following officers were elected to serve during the ensuing year :

President, Richard Murphy, of Murphy & Atkinson. First Vice-President, Thomas McNeil, of T. & J.

Second Vice-President, Frederick Lamping, of Fred-

Second vice-fresheld, Frederick Framping, of Frederick Lamping & Sons.

Treasurer, James A. Gibson.

Secretary, N. K. Aylward.

Sergeant-at-Arms, Stephen Noland, of Noland Bros.

After the election of officers, the afternoon was taken up in passing on the proposed amendments to the plumbing laws, which are to be taken to Columbus, January 19.

THE Chicago Master Plumbers' Association, under the new President, Andrew Young, announces several lectures the coming year before the association, the lecturers including Health Commissioner Oscar C. De Wolf and De Witt C. Cregier.

THE Chicago Builders' and Traders' Exchange will be officered this year as follows: President, George Tapper; Vice-Presidents, Francisco Blair and M. Madden; Treasurer, Joseph Downey; Secretary, J. A. Pettigrew; Directors, F. S. Wright, W. H. lliff, E. A. Thomas, E. A. Wells, Thomas Moulding. The membership is 511.

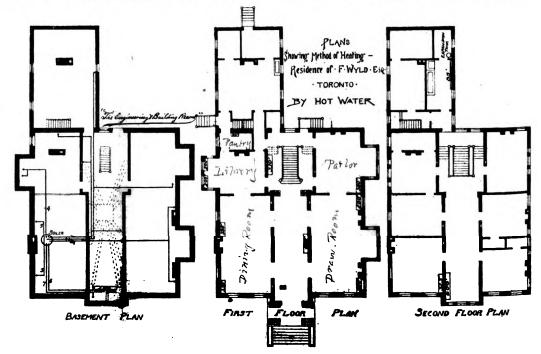
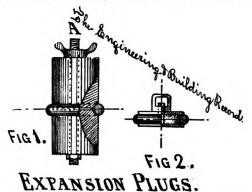


FIGURE 3. Digitized by Google

PLUGS USED IN TESTING SOIL-PIPES.

LONDON, December 30, 1887.

SIR: I notice this inquiry and beg to remind you that I sent an illustration of one invented by Mr. Charles Hawkesley, M. Inst. C. E., and which was shown at the International Health Exhibition held in London in 1884. But on referring to my bound volumes of your journal I fail to find it or that you made use of it. I now send another pen-and-ink sketch of it (see Fig. 1). It consists of two hard-wood blocks turned in a lathe, a little smaller than the pipes to be tested. An India-rubber ring is placed as shown. On screwing the blocks tightly together, the



ring bulges outwards and presses closely against the inside of the pipe. The screw consists of a piece of iron barrel, with screwed ends and fly-nuts. A cap should be screwed on at A when water pressure is being applied. An air-pump or a pressure-gauge can be attached if the pipes are being tested pneumatically. Figure 2 is a sketch, half in section, of the plugs used by the writer. They are made of malleable cast iron, with a screwed bolt cast on the bottom plate, and a brass bow headed nut and India rubber ring, as shown. In your journal, Vol. II., page 133, is an illustration showing a section of a manhole cover. Several London engineers use stoppers made as there shown, and they answer admirably when made to suitable sizes for plugging drains. Yours truly,

HOW PLUMBERS MAKE LEAD BENDS. NEW YORK, January 25, 1888.

J. W. C.

SIR: In your issue of January 7 I had the pleasure of reading an article on "pipe bending," from a Western correspondent, and the want of sufficient time only has prevented me until this late day from taking a few exceptions from the gentleman's assertions and making a few remarks from a different standpoint.

Keeping in mind the ancient adage that "what may cure one will kill another," and appreciating fully that many miles intervening, it is possible that my suggestions may seem to my fellow-workman as unreasonable and useless when applied to his management and methods, as his suggestions seem to me, yet 1 ask permission to assume the negative and explain the manner in which a New York plumber would make bends in a lead pipe.

The method he proposes is not original with him; neither is the method which I will speak of original with me, as it has been pretty generally adopted here for some time past.

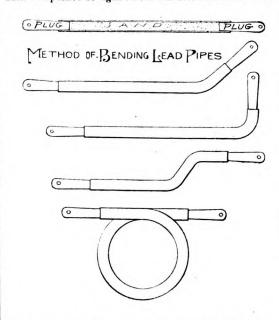
The rounded block has been in more or less use here for some years in bending metal pipes, more especially brass and copper pipes, which have recently been used for exposed and ornamental plumbing-work to considerable extent, but latterly the block has been discarded for different and better methods.

If your correspondent is interested in lead bends made with sand, let him procure from a "wood-turner" eight tapered maple plugs, or of any wood of similar close-fibred nature, and he has then fully equipped himself to make bends in 1 inch, 11/4 inch, 11/2-inch, and 2-inch lead pipe. The plugs should be about 12 or 14 inches long each, and those for bending 1-inch pipe to be 78-inch at one end, tapered up to 11/8-inch, and at the large end a 1/2-inch hole should be bored at right angles with the length of plug and entirely through the same about 21/2 inches from large end. The plugs for bending 11/4-inch pipe should be 11/8 at small end, tapered up to 13% and made in same manner; those for 11/2-inch pipe tapered from 13/8 to 15/8, and those for 2-inch pipe from 1 7/8 to 2 1/8 inch.

Now to make a bend in a 2-inch pipe dry white sand is the best, and, after driving one of the 2-inch plugs into

one end of the pipe, which should go in about three inches if the plugs are tapered right, fill the pipe with sand and stand it up in a vertical position with the plugged end down.

Now tap the pipe gently, commencing at the bottom, with a soft-pine dresser, and work slowly up to the top of the pipe, continually tapping gently to settle the sand until it is packed so tight that it will settle no more. Now



fill up the pipe again and repeat the action, leaving about three inches unoccupied for the admission of the other plug. Now, holding the pipe an inch or so clear of the floor, drive in the other plug until it strikes the sand, which you will know by the plug expanding the pipe.

Now we have a solid body of sand encased by lead pipe and held firmly in position by the two plugs. Care must be exercised while bending to keep the plugs driven home at all times, or otherwise the bend will "kink" at the throat when bending is commenced.

Next heat the pipe at point desired to bend by burning paper under it or holding it over charcoal fire. When it is hot enough to hiss when spat upon it is ready to bend.

Now, place it flat on the floor or bench, and with the left hand place a felt or cloth over the heated portion and grasp the pipe firmly to hold it in position, while with the right hand grasp the plug near the end of the pipe and raise it, forming an angle of about 45° at the first time. Now stand the pipe up as at first and dress it down to pack the sand as before, as the bending has spread the sand and loosened it. After dressing down, drive the plug home again and repeat the bending process once or twice, or more if necessary, to produce desired angle.

After bending in this manner, I think your correspondent will light his fire with the bench-blocks.

I have spent more time in explanation, in order, if possible, to be plain, than it would take to do the job.

I neglected to say that the holes in the end of the plugs are to place a bending-iron in to drive them out of the Yours, etc.,

OFFICIAL INSPECTION OF PIPING FOR NATURAL GAS AT INDIANAPOLIS.

THE Builders' Exchange of Indianapolis are rendering that community a real service when they are urging on the Common Council of that city the adoption of an ordinance looking to the protection of the lives and property of citizens by securing the inspection of the work connected with the introduction of natural gas. We do not know whether Indianapolis has a plumbing law or not, but, as much as that is needed, it is more important that some control should be had over the class of men that will undertake to do the work connected with the introduction of natural gas, since, as has been stated, whenever there is any unusual amount of work in a community, that fact attracts to it incompetent and irresponsible men from other localities, who go there to make what they can by scamping work, defrauding creditors, and then leaving the town for a new locality where there is a sudden demand for the services of mechanics. The resolutions of the Exchange, which we quote from the Indianapolis News, are as follows:

"Whereas. The introduction of natural gas into Indianapolis will necessitate the immediate plumbing of the

houses for its use; and whereas, the experience of other cities has shown that natural gas is a dangerous element, and requires the best character of pipe and plumbing-work to be done to avoid accidents; and whereas, the large and unusual demand of the public for its introduction will induce incompetent and inexperienced persons to attempt the work, and thus imperil life and property; therefore, be it

"Resolved, That we are in favor of the appointment at once by the City Council of a competent man to act as inspector, who shall be required to examine and test all pipes, fixtures, and connections in a house before natural gas shall be turned into said house; that said inspector shall issue his certificate, stating that he finds the work is sufficient and safe, or, if in his judgment such work is insufficient and unsafe, he shall so certify, and shall spe-

sufficient and safe, or, if in his judgment such work is insufficient and unsafe, he shall so certify, and shall specifically set forth wherein the work or material in question is insufficient or unsafe, and said inspector shall leave such notice with the owner or occupant of the house and a copy thereof with the president or superintendent of the gas company proposing to furnish gas to said house, and to prevent arbitrary or interested action on the part of such inspector he should be required to give a bond holding him liable to any person who may be injured by his action should he without cause, or from corrupt and interested motives, falsely certify to the condition of said plumbing. "Kesolved. That with the same purpose in view to protect life and property against unsafe or insufficient naturalgas plumbing, all persons desirous of doing such work in the city of Indianapolis shall, before undertaking any job of natural-gas plumbing, file with the City Clerk his application, with a sworn statement of the experience he has had in natural gas or other plumbing and the certificate of a resident architect that in the opinion of such architect said applicant is competent to do natural-gas plumbing, and said applicant shall at the same time file with the City Clerk his bond in the sum of not less than \$2,000, helding said plumber liable to the person injured for any and all damages which may arise from any accident occurring by reason of any ascertainable defect in the material or negligence in the work performed in making any fitting or connection on the pipes or fixtures put in by him for the conveying of natural gas.

"Be it further resolved." That the Chair be requested to veying of natural gas.

"Be it further resolved, That the Chair be requested to appoint a committee of five from the Builders' Exchange to convey to the City Council this resolution, and to assist in any effort that may be made in carrying out the objects

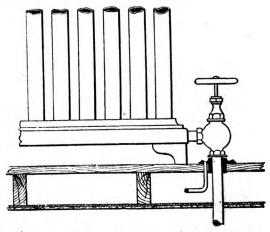
J. C. Adams, George Weaver, Conrad Bender, William Terrell, and M. S. Huey were appointed a committee in accordance with the terms of the resolutions.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

SAFETY-PLATE FOR STEAM-RADIATORS.

EDWARD W. MARSH, of Hartford, Conn., has patented a novel floor-plate for radiators in connection with an angle or radiator valve. The plate is somewhat of the usual form, but with a channel for water in its upper face.



SAFETY PLATE FOR STEAMPIPES

From this channel a small drip-pipe is run to any suitable place to carry off any leakage. A projecting rim at the lower end of the valve is of just sufficient width to shed the drops into the channel as they run from the stem or stuffing-box.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

A GARBAGE CREMATOR AT MILWAUKEE.

MILWAUKEE, WIS., January 18, 1888.

SIR: Replying to the query on page 108, I will state that we have a garbage-cremating furnace in this city. It is owned by William Forrestal, who was the builder of it. He is paid the sum of \$10,000 per annum by the city for consuming the garbage, and it has worked satisfactorily so far. William Forrestal's address is 1513 Cedar Street. W. G. NICHOLSON.

PLAN FOR VENTILATING MONTREAL SEWERS WANTED.

HEALTH DEPARTMENT, CITY HALL, MONTREAL, January 7, 1888.

SIR: A committee appointed by our Board of Health is now inquiring into the best means of ventilating public sewers, and they are desirous of obtaining the views of the most competent authorities on the subject. So, having been instructed to invite your opinion, I would request you, should it not be an inconvenience, to impart to us your views as to what method it would be best for us to adopt to ventilate our sewers, whether through the manholes, the gullies, or through the private drains and soil-pipes, taking into consideration our climate. As you soil-pipes, taking into consideration our climate. As you are aware, our streets, in the winter time, are often covered with snow and ice to the depth of several feet, a difficulty not met with in warmer latitudes.

An early reply will be looked upon as a great favor.

Yours truly, J. IGNATIOS FLYNN,

Secretary Board of Health.

[See editorial elsewhere.-ED.]

REMOVING WATER CONDENSED ON INSIDE OF WINDOWS.

DETROIT, January 20, 1888.

SIR: Please inform me in the next issue of your highly-appreciated paper the best method of disposing of water caused by the melting of ice and condensation on the inside of windows. I have recently completed a church which is heated by steam. I am much troubled with the water from the windows. I have made openings at bottom of window frames to convey the water outside the building, but they freeze up and are not effectual.

ALBERT E. FRENCH. Yours truly,

[The excessive moisture complained of is possibly due to the newness of the building, which not being continuously heated, the plastering, etc., dries slowly.

Perhaps the best thing that can be done is to run a Emall drip-pipe inside from each window down into the cellar, where, as the quantity from each window would be

small and the intervals between discharges long, there would be no objection to its discharge on the cellar floor. The use of outside sashes in winter would relieve and perhaps remove the difficulty and might save enough fuel to make them not very expensive in the long run. A radiator under each window would have a similar effect. Before doing anything else, however, it would be well to see if the cause cannot be removed, which, in the case of such excessive condensation, we should be inclined to think might be in some small steam-leaks in the heating-apparatus which charge the air with moisture. Small steamleaks, not otherwise perceptible, are sometimes detected by the dew on an adjoining window. It is very difficult to find a small steam-leak in a warm room, but perhaps by opening all the doors and windows while steam was on, some might become visible. A still more certain way would be to fill the heating-apparatus with water and apply pressure. At least, it would pay to see that all air-valves and stuffing-boxes were thoroughly tight. If condensation occurs in the daytime when the church is empty it can safely be laid to steam-leaks, unless indirect radiation is used with a water-pan to moisten the air which may be too efficient.

In the evening, in ill-ventilated rooms, the water from the combustion of the gas will add much to the moisture of the air. This can be readily shown by holding over a gasjet a cold spoon on which dew will quickly form and as quickly disappear when the spoon gets hot.]

SUGGESTIONS FOR THE "L" ROADS.

NEW YORK, January 7, 1888.

SIR: Travel on the elevated roads becomes daily more tedious and uncomfortable, to say nothing of the carelessness and danger exemplified in the many recent blockades and accidents, two this week on Third Avenue within 15 hours and at the busiest times.

Probably we will have to endure all until the maximum discomfort forces investments in substantial competing lines or a hitherto miraculously delayed slaughter causes suitable precautions for safety to be enforced. Meantime, one or two especially obvious measures would relieve the pressure, save time, and increase the possible traffic.

First—Let the platforms of all the principal stations be extended 50 to 100 per cent; correspondingly augment the

extended 50 to 100 per cent.; correspondingly augment the number of cars in each train and draw it by two engines,

one front and one rear, or both front, and separated as far as may be requisite for capacity of structure.

Second—Let all trains be classified under, say, four heads, A. B, C, and D, each class following successively the other

Let the stations be numbered consecutively from one end, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, etc. Train A steps at I and 2, 5 and 6, 9 and 10, etc., skipping 3 and 4, 7 and 8, 11 and 12, etc.; Train B stops at 1, 2, and 3, 6 and 7, 10 and 11, etc., skipping 4 and 5, 8 and 9, 12 and 13, etc.; Train C stops at 1, 3, and 4, 7 and 8, 11 and 12, etc., skipping 2, 5, and 6, 9 and 10, etc.; Train D stops

at 1, 4, and 5, 8 and 9, 12 and 13, etc., skipping 2 and 3, 6 and 7, 10 and 11. Next Train A stops at 1 and 2, etc., as first one did.

Thus no passenger at any station would have to wait more than three trains for one stopping at any given point, and only half the number of stops would be made by the

Either of these arrangements would be practical, and if this suggestion does no other good it may elicit further attention to the subject.

SUFFERER.

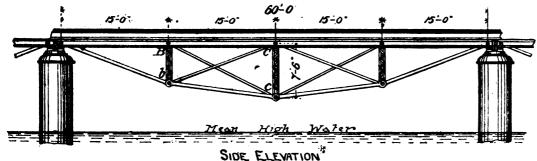
[Our correspondent's suggestions are certainly ingenious, and we share his hope that they may elicit some profitable discussion. We think, however, that it would be difficult to get two engines to work together without straining or slipping as promptly as elevated road work requires, especially if separated by the length of a train, which should be under the instant and absolute control of

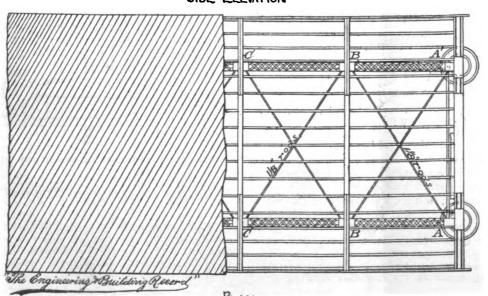
In regard to his second suggestion, it will be noted that as long as all trains stop at the same stations the distance between consecutive trains will not vary greatly, and the headway or time between trains may be reduced to a minimum, but if they stop at alternate stations they will be continually gaining or losing ground with reference to each other, so that safety will require the headway to be increased and fewer trains can be run per hour, which would largely offset the increased speed due to stopping at fewer stations, and what with the delay of waiting for the right train and the danger of getting in the wrong one, we think the plan would be "more plague than profit."]

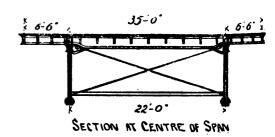
IRON PIER AT MARINE PARK, BOSTON.

THIS pier is being constructed by the Builders' Iron Foundry, Providence, R. I., from designs and specifications prepared under the direction of City Engineer William Jackson, and consists of twelve wrought-iron deck spans resting on cylindrical cast-iron piers, which are set radially on a curve of 2,500 feet radius to the centre of the structure. The lower sections of the piers are about eight seet long each, and the flange-joints are made water-tight with red lead and packing. The piers are sunk till they extend at least eight feet into hard bottom, all earth and other material being removed from inside them as the sinking progresses, and the cylinders filled with concrete made from the best Portland cement. The bottom underneath the piers is of a hard, tough clay. and the material above it is such as to prevent water entering the cylinders while being sunk.

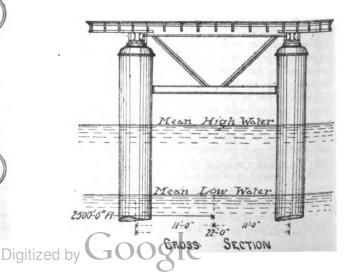
The average rise of the tide is 10 feet, and the flooring is 241/2 feet above mean low water. The longitudinal trusses are supported on castings which are bedded in the concrete filling of the pier. They have expansion con nections allowing for longitudinal movement at their free ends upon faced transverse bearing strips.







TRON PIER AT MARINE PARK · BOSTON·MASS·



The transverse girders connecting the piers in pairs are entirely independent of the adjacent spans, and are supported on vertical struts that pass through slots in the caps of the piers, and extend nearly five feet below them, where they terminate with horizontal bottom angles that are firmly bedded in the concrete filling, which is carefully brought to the required level, and, after these supports are bedded, the remaining space in the piers is filled with concrete and cement-mortar thoroughly rammed around the supports.

This arrangement, while it relieves the shell of the piers from all load and requires it merely to protect and confine the enclosed concrete, also provides against small inaccuracies in grade and position of piers when placed, as any such irregularities can be readily overcome when bedding the supports in the concrete.

This as well as other details are clearly shown in the accompanying illustrations.

ENGINEERS' CLUB OF PHILADELPHIA.

THE tenth annual meeting of the club was held January 14, 1888, President Thomas M. Cleemann in the chair; Howard Murphy, Secretary and Treasurer; 44 members and I visitor present.

The retiring President, Mr. Thomas M. Cleemann, read the annual address.

Mr. Cleemann urged upon the members the necessity of keeping up the club with the ablest of the young engineers, and reminded them that many of the greatest inventions and discoveries relating to engineering originated in Philadelphia and its vicinity. The first successful steamboat, the first locomotive in America, were made by her citizens. The first permanent tramway, the first engineer's transit, the first modern suspension bridge (with a stiffening truss), the first wire suspension bridge, the first arched bridge hinged at the middle and the ends, all originated in Pennsylvania.

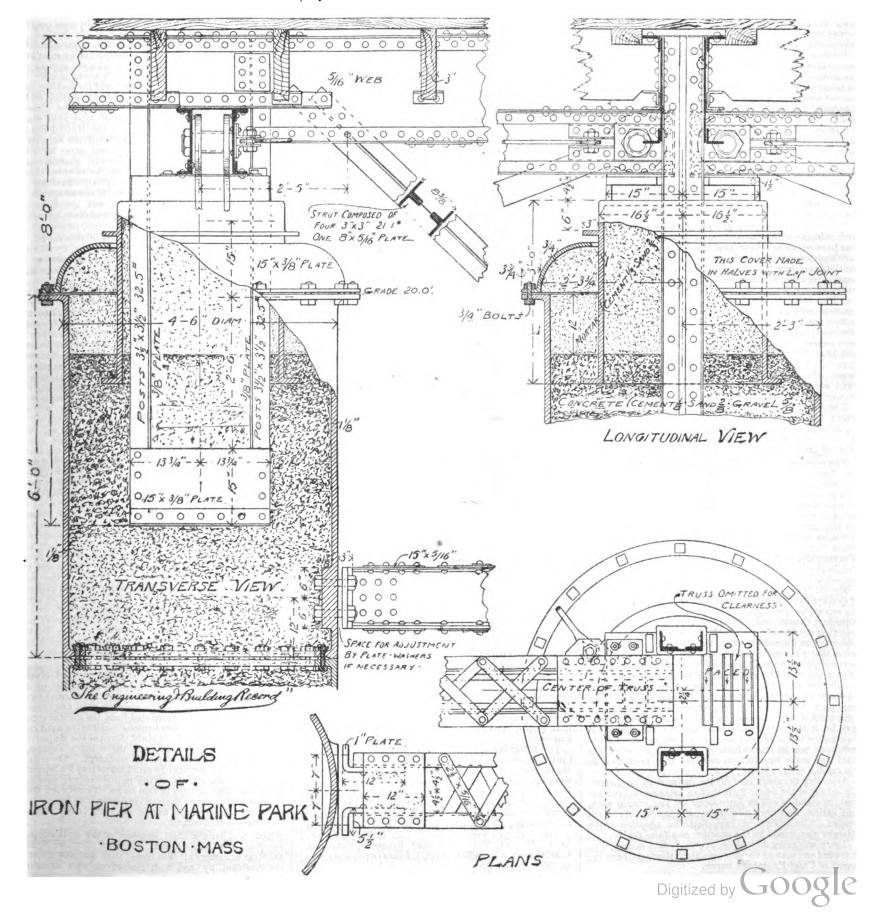
He recommended a more agressive spirit in claiming recognition from the city authorities when they required experts to advise them.

He referred to the Panama Canal, charging a want of good judgment in its location and management, and claiming that the latest advices, showing an abandonment of the projector's favorite scheme of a sea level canal, so often and obstinately insisted on by him, made the Nicaragua route superior.

He also referred to the extraordinary depths of the foundations of the Hawkesbury Bridge, the great spans of the bridge over the Firth of Forth, and the proposed North River bridge at New York, to surpass all others in size.

The following persons were elected active members: Messrs. Louis H. Parke, Barton H. Coffey, Agnew T. Dice, Simon C. Long, Jacques W. Redway, Samuel Bell, Jr., George W. Chance, Charles H. Haupt, George W. Creighton, Jawood Lukens, Alan Wood, Jr., Charles R. Hall, Robert A. Cummings, T. W. Simpson, General W. F. Smith, Charles Lukens, Herbert Bamber, and Barnabas H. Bartol; and as associate members, Messrs. George T. Mills, Michael Clarkson, and A. J. Rudderow.

The officers elected for 1888 are as follows: As Presi-



dent, Joseph M. Wilson, as Vice-President, J. T. Boyd; as Secretary and Treasurer, Howard Murphy: as Directors, T. M. Cleemann, Frederic Graff, Professor L. M. Haupt, Washington Jones, Henry G. Morris.

President elect Joseph M. Wilson, in taking the chair, cold.

said:
"Fellow Members:—I beg to thank you for the compliment vou have paid me in electing me to the position of your Pre-ident, and I trust that I may be able to show my appreciation of the honor and my deep interest in the club, not only by giving my earnest attention to the duties which appertain to the office, but also by using my utmost endeavors to encourage whatever will tend to the club's advancement and prosperity. I am very much afraid, however, that my efforts will suffer by comparison with the e of my worthy predecessor, whose deep, earnest devotion to the welfare and progress of the club and close attention to duties, have gained for him a reputa-

tion that it would be difficult to surpass.

"A club of this kind has a wide field open to it, with "A club of this kind has a wide field open to it, with great capabilities for good work, even greater in some respects than would, perhaps, obtain in a more prominent or more widely spread society, where the restrictions and liabilities are increased. The young life, the liberality as to eligibility, the local interest and acquaintance among the members, and the freedom from the trammels that would encompass an older and more conservative organization, where the establishment of a precedent must always be considered, give greater opportunities and enable matters to be taken up and discussed in a way and enable matters to be taken up and discussed in a way

and enable matters to be taken up and discussed in a way that would hardly obtain elsewhere.

"There are numerous practical subjects of great importance and interest, not only to the engineer, but to the architect, the manufacturer, or the citizen, that might be brought before the club with advantage. Much of this kind of work has already been done, but cannot the usefulness of the club be still further increased in this direction? For instance, there are local questions upon which a gratuitous opinion from among those best qualified to judge might be of great benefit to the public. Papers upon the practical details of such matters as lighting by electricity, electro-motors, storage-batteries the heating electricity, electro-motors, storage-batteries, the heating and ventilating of buildings, sanitation, practical information on the locality and quality of the various woods, stones, and other materials used in construction, and an almost endless variety of subjects might be proposed for

this purpose.

"It would be an excellent thing to prepare a list of such subjects, and to have it posted where all may see it, and from which selections could be made.

"Members might hand in new suggestions from time to time, as they telt the want of information. These papers need not be long—the closer they adhere to the practical part of the subject the better.

"The club numbers among its members very many practical men in all departments of engineering, architecture, and manufacturing, and itsgenerous policy as to admission to its associate class makes it just the place for

such papers. "The club has had a good past, it is in the tide of present success, and before it lies a great future, if it is properly developed and encouraged. My heart and hand are with it. Will you all join me in wishing it prosperity?

The Secretary and Treasurer presented his annual The Secretary and Treasurer presented his annual report for the fiscal year 1887, as follows: Receipts, \$4,332.65; expenditures, \$4,111.36; balance, \$556.48; other assets, \$1,237.20, which does not include the value of the library.

The membership at the end of 1886 was 468; additions, 32; deceased and resigned, 25; at the end of 1887, 475,

32; deceased and resigned, 25; at the end of 1887, 475, of wnom 221, active members, reside in Philadelphia.

A communication was received from Mr. Walter Wood. Chairman of the Finance Committee of the Local Entertainment Committee of the American Society of Mechanical Engineers, transmitting to the club \$206.35, a portion of the unexpended balance in the hands of that committee, which the subscribers desired to present to the club. [Presumably, in acknowledgment of the courtesy of the club in placing their house at the disposal of the committee.—ED]

club in placing their house at the disposal of the committee.—ED]

Mr. A. Marichal read a paper on the "Plan Formation of Quaker Bridge Dam." The topic of his discussion was the report, by the engineers in charge, to the New York Aqueduct Commission, on the "Non-Advisability of Constructing the Dam on a Curve." The author of the paper says: "The formula used by the designers in order to prove that a pressure of 46.8 tons per square foot would be transmitted to the voussoir joints, if the dam would act as an arch, would be good only for an ideal dam, without be transmitted to the voussoir joints, if the dam would act as an arch, would be good only for an ideal dam, without any thickness, without any elasticity, offering no resistance whatever to the water-pressure. As soon as you jump from pure theory into practice, you are compelled to give some thickness to your wall; and no matter how thin it may be, it will offer some resistance to the horizontal thrust of water, and only the excess, not carried by the wall itself, will be transmitted to the abutment, which will react and make acquilibrium provided the reactions. react and make equilibrium, provided this reaction does not reach a certain limit."

not reach a certain limit."

Assuming the limit fixed by the designer to be correct, the author of the paper finds that an increase of 100 per cent. of stability will be introduced by the curved plan, and claims that this additional stability is very much needed. Concluding, he says that the adoption of the straight plan would be the sanction of a false theory.

There was some discussion by Mr. J. E. Codman, who defended the plan of the dam quoting abstracts from the

defended the plan of the dam, quoting abstracts from the report of Chief Engineer Church.

Mr. H. S. Pritchard presented an illustrated description of a graphical method of determining the deflection of bridges. An open draw-bridge is chosen for illustration. The usual formula for calculating the variations in the length of each member, due to the strain, is given. Then, means of diagrams, a graphic method of obtaining the deflections from these variations in length is explained, its application to the draw bridge shown, and suggestions given for its use in other forms of bridges.

THE OHIO SOCIETY OF SURVEYORS AND CIVIL ENGINEERS.

This society held its ninth annual meeting at Columbus. O, January 10, 11, and 12. The attendance was larger than at any previous meeting. Among those present were: M. E. Rawson, of Cleveland; W. H. lennings, of Columbus; John L. Culley, of Cleveland; Benjamin Thompson, of Urbana; A. G. Pugh, of Columbus; J. S. Humphrey, of Garden City, Kan.; E. D. Shreve, of Mansheld; Frank M. Kennedy, of Washington C. H.; Homer C. White, of Warren.

On the first day the following papers were read: on "The Judicial Functions of the Surveyor," by Homer White, of Warren; a paper on "Adverse Possession," by E. D. Haselton, of Mahoning County; on "Steel Tapes as Standards," by Prof. J. B. Johnson, of Washington University, Mo.; an address by George R. Gyger, of Alliance, on "Protection from Incompetency," and a historical sketch of "Our Public Domain," by J. T. Bruck, of Cardington. THIS society held its ninth annual meeting at Colum-

of Cardington.

The evening exercises were opened by the address of President W. H. lennings. Dr. Edward Orton. of Ohio State University, gave a lecture on "Road-making Materials of the State." Professor Orton was followed by Mr. C. A. Hanlon, of Massillon, O., who presented a paper entitled "A State Topographical Survey." The evening closed with a report of the Committee on Civil Engineer-

The afternoon of the second day was largely spent in discussing the material used in paving of streets and making of roads. A free exchange of opinion as to the merits of certain paving stones was made and considerable attention paid the manner of laying them.

A committee from the Centennial Commission, who waited upon the society for the purpose of having a display A committee from the Centennial Commission, who waited upon the society for the purpose of having a display of relics of the profession 100 years ago, at the coming centennial, was informed that their request would be complied with so far as was possible. The following papers were read during the day: By Jonathan Arnett of London, Madison County, on "Philosophy of Underdrainage;" by Frank Kennedy, of Washington C. H., on "The Catfish System of Drainage;" by G. S. Innis, of Columbus, on "Construction of Turnpikes;" "Notes on Paving," by Thomas R. Wickenden, of Toledo; "Cleveland City Pavements," by M. E. Rawson; "Street-Crossings and Sidewalks," by R. A. Bryan, Portsmouth; "Street Grades and Records," by W. H. Jennings, Columbus: "Construction, Maintenance, and Repairs of Short-span Highway Bridges," by S. A. Buchanan, Bellefontaine: "Computation of Strains in Highway Bridges," by Professor C. N. Brown, Ohio State University; H. T. Lewis, on "Bridge Details;" "Lifting and Moving of Bridges," by Thomas H. Johnson, Columbus: "Pile Foundations," by Julian Griggs, Columbus; "Masonry as Applied to Railroad Work." by A. G. Pugh, Columbus; "Puzzles for the Enquirer," by W. A. Gain, Sidney; "Comparative Cost and Efficiency of Tile Drain and Open Ditches," by E. O. Opedycke, of Bryan; "Street Grades and Monuments," by C. S. Lee, of Marysville; "Monumenting," by F. Hodgman, of Climax, Mich.

On the morning of the last day the reports of the retiring officers were submitted and approved, and a number of

On the morning of the last day the reports of the retiring officers were submitted and approved, and a number of

officers were submitted and approved, and a number of papers were read and discussed, among them being one by W. C. Rowe on the Circleville water-works; also, one by B. F. Bowen, of Columbus, on "Mortar," and by William Reeder, of London, of the "Difficulties of Surveying in the Virginia Military District."

A petition signed by W. H. Jennings, chief engineer of the Hocking Valley Railroad Company, and nine other Columbus engineers, asking for permission to form a local association, was favorably acted upon. The Committee on Legislation reported in favor of abandoning the wortless portion of the Ohio Canal, but no action was taken on the report other than its acceptance. the report other than its acceptance.

matter of an exhibit during the Centennial in Columbus in September was referred to the local members of the association with power to act. The Committee on Legislation was instructed to formulate a bill to govern

Legislation was instructed to formulate a bill to govern the qualifications of persons acting as civil engineers in this State, for presentation at the next annual meeting. At the afternoon session J. N. Bradford, cf Ohio State University, gave an illustrated lecture on 'Duplication of Blue Prints," and Mr. Cully read a paper on 'Landscape Engineering."

The following persons were elected members: B. E. Cutler, Zanesville; Alvin Morrow, Paulding; Henry E. Mann, Ashtabula; W. H. Leggitt, Columbus; James T. Egerton, Ironton: Frank Snyder, Columbus; William J. Hester, Cambridge; George B. Nicholson, Cincinnati; M. P. McCoy, Van Wert; James Swisher, Urbana; A.W. Jones, Columbus; T. H. Doyle, Legan; Samuel Huston, Steubenville; E. C. Slater, Findlay; D. R. Slattermann, Dayton; H. J. Lewis, Columbus; M. J. Riggs, Toledo; G. A. Masters, Toledo; Samuel Bachtelle, Columbus; J. M. Harper, Cincinnati. Prof. Edward Orton was elected an honorary member.

The following officers were elected; President, J. D. Varney, Cleveland; Vice President, O. B. Opdycke, B Varney, Cleveland; Vice President, O. B. Opdycke, Bryan; Secretary, C. N. Brown, Columbus; Treasurer, F. G. Sager, Columbus; Trustees, W. H. Jennings, Columbus; T. R. Wickenden, Toledo; F. M. Davidson, West Manchester; C. A. Judson, Sandusky; William Reeder, London

Suitable resolutions were adopted on the death of I.S.

Ellis, a member.
The meeting, which has been the most successful in the history of the organization, adjourned until the next annual meeting, which occurs next year in the same place.

A NATIONAL BUREAU OF HARBOR AND WATERWAYS.

THE following bill. which is of interest to engineers, has been introduced into the Senate of the United States by Senator Collum, of Illinois, who was active in securing the passage of the Inter-State Commerce Act;

Be it enacted by the Senate and House of Representives of the United States of America in Congress assembled. That there shall be under the War Department a bureau to be known as the Bureau of Harbors and Waterways, to be officered by a corps to be known as the Corps of United States Civil Engineers.

ates Civil Engineers.
SEC. 2. That it shall be charged with the construction execution, conduct, and preservation of the harbor and waterway works in aid of Lavigation, now completed or waterway works in aid of lavigation, now completed or possessed, or in the course of construction or operation by the United States, including what is known as snagging and dredging operations; and all such works as may now or hereafter be provided for by law; and the making of all examinations, surveys, plans and estimates, relating to harbor and waterway improvements; and it shall be charged with the supervision of all crossings of navigable waterways which are under the control of the United States. ways which are under the control of the United States; and it shall be charged and intrusted with the care of all and it shall be charged and intrusted with the care of all the beats, instruments, implements, and plant of ever kind relating to such operations, werks, examinations, and surveys; and all the records and documents relating to the same as may now be, or may hereafter become the property of the United States, all under the direction and authority of the Secretary of War; and the President shall see that the transfers herein contemplated are fully and promptly made. and promptly made.

SEC. 3. That there shall be a chief of this corps, one learned and experienced in civil engineering, and especially with reference to harbor and waterway works, who shall be located at Washington. There shall likewise be four associate chiefs located at Washington, and of qualifications similar to those required for the chief, and they shall be known, without distinction of rank among themselves, a associate chief engineers. One associate chief selves, as associate chief engineers. One associate chief shall be assigned to duty in the office of the chief, and the others shall be assigned to such divisions of the harborand waterway works as the Secretary of War may approve or direct. The chief shall be charged, under the Secretary of War, with the execution of all laws and duties pertaining to the corps, and during his absence or sickness the associate chief in connection with his office shall act in his stead or under his lawful orders. These engineers shall also constitute an advisory board for all such questions as may be submitted or referred to them by the department engineers, by the Secretary of War, or or Congress. There shall be not more than eleven or less than nine engineers to be known as department engineers. who shall have charge of such divisions into departments as may be made of the harbor and waterway works, and they shall be located at such central or convenient points in the departments as may be directed. There shall be as many engineers, to be known as division engineers, as may hereafter be required, but not to exceed fifty in number.
who shall have charge of such groups of works and surveys in the several departments as can be conveniently administered from the same headquarters. There shall be as many engineers, to be known as first assistant engineers, hereafter be required, but not to exceed one hundred in number, who may have local charge of the works and surveys under the direction of the division engineer.
There shall be as many engineers, to be known as second assistant engineers, as may be hereafter required, but not to exceed two hundred in number. There shall be as many cadets, to be known as cadet engineers, as may be hereafter required, but not to exceed two hundred and fifty in All officers and cadets shall be citizens of the United States.

SEC. 4. That the chief engineer of the corps of civil engineers may be appointed from the present corps of military engineers, but of not lower rank than colonel in said military corps, and half of the associate chief engineers of said civil corps may be appointed from the military corps, but of not lower rank than lieutenant-colonel in said corps. Five of nine, five of ten, or six of eleven of the department enginers may be appointed from the military corps, but of not lower rank than major in said corps. One-half of the division engineers herein provided tor may be appointed from among the officers of the military corps, but of not lower rank than captain in said corps. Twenty of the first assistant engineers of the civil corps may also be appointed from the military corps, but of not lower rank than first from the military corps, but of not lower rank than first lieutenant in said corps.

SEC. 5. That the chief engineer of the civil corps, the associate chief, department, division, first and second assistant engineers of said corps shall be appointed by the President by and with the advice and consent of

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the Senate. In the initial organization of the corps the appointment of associate chief, department, and division engineers shall be made upon the recommendation of the commission hereinafter provided for; and the appointment of first and second assistant engineers shall be made upon the recommendation of the board of United States civil engineers established by the President. The cadets of this corps shall be appointed by the Secretary of War upon examination by a duly-constituted board. All appointments to this corps shall be with special reference appointments to this corps shall be with special reference to experience, capacity, training, and fitness for the kind of work assigned to this corps, and in case of the office of chief engineer of said corps becoming vacant, it shall be filled by the appointment of one of the associate chiefs to that office; and vacancies in all other grades shall be filled by promotion from the next lower grade of the corps; Prov ded, however. That one-third of the vacancies occurring in any one year in the grades of second assistant engineer and first assistant engineers may be filled by engineers not formerly members of the corps, who may present themselves as candidates and submit to such exampresent themselves as candidates and submit to such examinations and tests as may be provided for in the rules and

SEC. 6. That the relative rank in each grade below that of associate chief engineer shall be determined by date of commission, and in the initial organization of the corps the engineers from the army shall takerank in alternate position with the civil engineers in each grade. Promotions from any such grade to a higher shall be in the order of seniority: Privided, however, That such senior officer in the grades of first assistant, second assistant, and cadet engineer shall be recommended for promotion by the examining board herein provided.

SEC. 7. That engineers from the army who shall accept appointments in this corps may resign any time within two years from the passage of this act and resume their connection with the army, without impairment of rank. As long as this option is retained they shall receive their pay in the usual manner as officers of the army on detached during dutv.

SEC. 8. That in making appointments to this corps below the grade of department engineer they shall be made upon the basis of work being, or that may be, conducted as herein authorized.

SEC. 9. That the pay of the officers of this corps shall be at the following rates per annum: Chief engineer, ten thousand dollars; associate chief engineer, seven thousand thousand dollars; associate chief engineer, seven thousand five hundred dollars; department engineer, six thousand dollars; division engineer, four thousand dollars; first assistant engineer, two thousand seven hundred dollars; second assistant engineer, one thousand eight hundred dollars; cadet engineer, one thousand dollars. All officers of this corps shall receive actual traveling expenses while traveling under orders; and the Secretary of War may employ special engineering counsel in connection with works he may deem of sufficient difficulty to make this step necessary: *Provided*, That funds for this purpose shall have been provided for by Congress.

Sec. 10. That when any officer of the corps arrives at

SEC. 10. That when any officer of the corps arrives at the age of sixty-five years, he shall be retired from active service in the corps, and shall, after such retirement, receive one-half of the per annum rate of pay to which he was entitled at the time of his retirement.

SEC. II. That no offier of this corps shall be employed upon work other than that assigned to this corps, except on the special order of the President, and such orders shall be reported to Congress by the Secretary of War.

SEC. 12. That for the purpose of formulating a system of rules and regulations for the proper administration of the duties of this corps, and for such other purposes as herein provided, the President shall appoint a commission, to consist of three Army engineers, of not lower rank than the grace of lieutenant-colonel, and three civil engineers, the grade of lieutenant-colonel, and three civil engineers, citizens of the United States, all of high attainments in engineering ability and experience. It shall be the duty of this commission to carefully prepare and present to Congress, as early as practicable, a system of rules and regulations for the government, direction, and guidance of the Corps of United States Civil Engineers, in matters pertaining to disbursement of funds, projects and care of property, discipline, employees, and all other matters which may properly come within the scope of such rules and regulations. This commission shall also nominate to the President such civil and military engineers as they may and regulations. This commission shall also nominate to the President such civil and military engineers as they may deem specially fitted for commission in the grades above first assistant engineer in the Corps of United States Civil Engineers. Such members of the commission as may not be under pay as Government officials shall receive a salary of four hundred and fifty dollars per month; and all nembers shall be paid their necessary traveling expenses. To defray the expenses of the commission, and for the compensation herein provided, the sum of ten thousand dollars is hereby appropriated, to be expended under the direction of the Secretary of War.

SEC. 13. That the Secretary of War shall divide the country with relevence to the harbor and waterway works into not less than nine, and not more than eleven departments, as nearly equal and uniform as may be, relative to drainage areas and topographical features, and the importance of harbors and waterways; and every department shall be under a department engineer.

SEC. 14. That no appropriation or allotment of money for a harbor or waterway shall be expended upon such work unless it is sufficient to provide for the completion of said work, or unless, in addition to the current appropriation, provision shall have been made

by law for funds necessary for its completion: Provided. That this shall not apply to snagging or dredging operations continuous in their nature, or to the care and keep of plant, property, and works, or to the operating of works wholly or partially completed, so as to be useful to commerce, such as locks and dams, or if the funds provided are adequate to complete in a permanent manner a particular and distinct stretch, reach, section, or part of said work, which shall, by and of itself, be sufficiently beneficial to commerce to justify the completion of said beneficial to commerce to justify the completion of said stretch, reach, section, or part, or to work that is designedly of a temporary character: Provided, however, That the funds spent upon a part of a temporary work shall contemplate as much stability for the part as is contemplated for the whole work: And provided further, That the expected benefit to commerce of the partial improvement shall be positive and advisable; it being the purpose and intent of this act that no power or discretion shall rest with the engineers or War Department to spend public money when they know and admit that the amount shall rest with the engineers or War Department to spend public money when they know and admit that the amount applicable to a work is insufficient to serve any useful public purpose, in connection with benefits to commerce or the completion of the work. No work shall be done except under a distinct and detail plan for each work, accompanied by estimates of annual needs of funds, and of the amount necessary for completion, and unless approved and authorized by Congress; and the Secretary of War shall carefully examine into all failures to complete work within the specified limits of time and money, and into all reasons assigned therefor, and report the same into all reasons assigned therefor, and report the same to Congress at each regular annual session, and he shall enforce the highest degree of economy, efficiency, and responsibility among and upon the members of this corps, and a rigid compliance with law by it, and he shall report to Congress upon those subjects at each regular annual session. Funds once appropriated for these works shall remain available for them until covered back into the Treasury by Congress; but allotments of a general fund, made by Executive authority, may be changed by order of the Secretary of War. SEC. 15. That in the preparation of plans and estimates,

and in reports upon the progress and conduct of works and operations all reports shall be made to the officer next in authority, to be duly and fully transmitted to the Secretary of War, and by him so transmitted to Congress Secretary of War, and by him so transmitted to Congress at each regular session. All transactions, expenditures, and results shall be fully reported in detail. In each annual report there shall be a financial statement under the head of each separate work, giving the original estimate of cost for total completion, the amount expended and on hand at the close of the last fiscal year ending June thirtieth of each year, the amount originally stated as required for each year, the total and the annual amounts appropriated, the amount still required, both annual and total, and whether the same is provided for.

SEC. 16. That in reporting plans and estimates as Congress may order, and in advising and recommending alteration of plans and estimates, the officer in local charge of the work shall state his views in a report to the division engineer, who shall forward it with his recommendations to the department engineer, who shall similarly forward it to the chief engineer for the consideration of the advisorv board.

SEC. 17. That each division engineer shall annually report to the department engineer upon the general commer-cial wants of his division with respect to harbor and waterway improvements, and in forwarding these reports to the chief engineer each department engineer shall make a similar report with respect to his department, and the advisory board shall likewise consider the matter in its broad na-tional relations; each shall report upon the present and probable commercial wants of their respective fields, and they shall consider and report upon them with respect to both their present and commercial wants, stating what may be deemed advisable improvements and what are the maximum improvements their harbors and waterways are capable of, it being the intent that all work shall tend to the most perfect class and standard of work, and, as far as may be, developed into a complete and harmonious national system. The advisory board is directed to recommend to Congress the best methods to obtain these results.

SEC. 18. That all estimates and requirements for this corps, or for the work under it, shall be reported by the Secretary of War to the Secretary of the Treasury, and be by him incorporated in the Book of Estimates and reported to Congress.

SEC. 19. That in case the officers of this corps shall, in obedience to the requirements of public works, as herein prescribed, exceed in number the subsequent requirements of the public works owing to the lack of appropriations, or for any other cause, the Secretary of Warshall temporarily refire those officers not actually employed upon halt pay, and during such period of retirement they may accept employment outside of Government service, subject to the approval of the Secretary of War; but otherwise the officers of this corps shall not hold any other civil office or engage in any civil or military occupation of a protessional character; and the Secretary of War may, out of the funds which may be provided for that purpose, detail officers to visit foreign works and study foreign methods and report upon the same.

SEC. 20. That the Secretary of War shall provide such Looks and methods of instruction for the corps as he may deem best and for which Congress may especially provide.

SEC. 21. That the Secretary of War shall have work done by contract, after due advertisement, when he shall be satisfied that such work can be done more cheaply, and

as efficiently, in that way than in any other way and to the best interest of the Government; and he shall take adequate bond and security for the proper performance of the contracts, and all such proceedings shall be reported in full to Congress.

SEC. 22. That all parts of acts in conflict with this act are hereby repealed, and all offices in connection with these works other than those offices herein provided for are hereby vacated and the offices abolished: *Provided*, I hat this does not relate to the corps of army engineers, except as to appointments herein provided for; but no vacancies in said corps hereby caused are to be filled more rapidly than now provided for by law.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Nanhattan Gas-Luht Company.	Metropolitan Cas-Light Company.	Mutua Gas-L.ght Company	Munic pal. Gas-Light Company.	Krickerb cker Cas-Lght Company.	Equitable Cas-Light Company.
January 21	23.24	19.25	51 Of	31.44	28.51	23 33	31 49

THE VOSBURGH TUNNEL.

A DESCRIPTION of its construction. Illustrated. Published with the permission of the Lehigh Valley Railroad Company by Leo Von Rosenberg, 35 Broadway, New York. 1887. 8½x11¼. 56 pp. Price, \$1.

This tunnel is in Wyoming Co., Pa., on the line of the Pennsylvania and New York Canal and Railroad, and, by piercing a high neck of land making a loop in the north branch of the Susquehanna, which the railroad here follows, a distance of more than four miles is saved. It was begun in 1883 and opened for traffic in 1886, in which year the road carried over three million tons. It is a was begun in 1883 and opened for traffic in 1886, in which year the road carried over three million tons. It is a double-track tunnel, 3,902 feet long. The error in meeting of the headings was: In line, 5% of an inch; in grade, 3% of an inch, and in distance less than one inch. Except for 250 feet the tunnel is in rock. The Chief Engineer was A. W. Stedman, Chief Engineer of the Lehigh Valley Railroad and associated lines. The engineer in charge was G. B. Owen, and the resident engineer, Isaac Dox. The contractors were Lents & Co.

In his preface the author says: "The Chief Engineer

In his preface the author says: "The Chief Engineer of the Lehigh Valley Railroad Co. assigned to the writer, who was then in the service of the engineering department of the road, the duty of preparing a set of drawings which would faithfully illustrate the methods employed in the construction of the Vosburgh Tunnel. These drawings were carefully prepared from working plans and personal examinations of the work. The material thus gathered has been supplemented by further interesting data and illustrations, so as to present an accurate and complete illustrations, so as to present an accurate and complete account of this important engineering work."

The promise of the preface seems to be well fulfilled in the book, which will be of much interest to any engineer and of special value to those engaged on similar work. It would be fortunate for the profession if all its important works were as carefully described.

JOHN A. BAILEY.

JOHN A. BAILEY, for many years engineer of the United States Government in connection with public works, died in Marquette, Mich., January 22, aged sixty-nine years. He entered the service of the Government in 1850, and had He entered the service of the Government in 1856, and had charge of the construction of the lighthouses along the Atlantic coast. He superintended laving the cable from Florida to Cuba; erected Spectacle Reef Light, in Lake Huron, in 1871. The last public work which he completed was the building of St. Annan Rock Light in Lake Superior. At the time of his death he was superintending the erection of the buildings of the Michigan branch State's prison at Marquette. prison at Marquette.

PERSONAL.

LIEUTENANT-COLONEL WILLIAM LUDLOW, Corps of Engineers, U. S. A., has been relieved from duty as Engineer Commissioner, District of Columbia, and Major Charles W. Raymond has been appointed by the President to fill the vacancy.

THE firm of Keister & Wallis, architects, with offices at Broadway and Thirty-third Street, New York City, has been dissolved. Mr. George Keister and Mr. Frank E. Wallis will continue the practice of their profession separately at the old address.

R. E. BRIGGS, late Resident Engineer of the Union Pacific Kailroad, has been made Chief Engineer of the Denver and Rio Grande Kailroad, and will have charge of the location and construction of new lines and general supervision of maintenance of way, including track, bri ges, buildings, and other structures, right of way and real estate.

GEORGE T. JARVIS, C. E., has been appointed Super-GEORGE T. JARVIS, C. E., has been appointed Super-intendent of the Duluth, South Shore and Atlantic Rail-road, which is almost completed. Mr. Jarvis is twenty-eight years old, a graduate of the University of Toronto, and he subsequently took a special course in mechanical engineering at the Massachuset.s Institute of Technology. He has been employed by the Pennsylvania Company, and is at present Division Superintendent of the Mexica n Central Railroad.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

RICHMOND, VA —The Masonic Temple Association has issued a circular, containing instructions, etc., to architects who may desire to enter into the competition, to furnish The following extract plans for the edifice. from the circular contains the terms of the competition:

"For the best design, accepted by the

Board, no premium will be paid, but the architect submitting it will receive \$3,000 in consideration of his furnishing, in addition, confideration of his furnishing, in addition, complete plans with full specifications and working drawings, the accuracy and completeness of all to be guaranteed by him, the \$3,000 to be payable as follows:

"Five hundred dollars on acceptance of the

plans, \$500 on receipt of the complete working, drawings and specifications, \$1,000 when the building reaches the second floor, and \$1,000 when the building is completed.

"For the second best plan, \$500; for the third best plan, \$300; for the fourth best

plan, \$200.

"The designs to be sent to the Committee on Plans, care of W. B. Isaacs, Secretary and Treasurer, not later than the 20th of March, 1888.

"The committee reserves the right to reject

any and all the designs submitted

The building is not to exceed \$100,000 in cost, is to be supplied with heating and ventilating apparatus, elevator machinery. etc., and is to be built of brick, stone (the latter of best quality), and terra-cotta ornamentation if desirable. All plans submitted must come if desirable. All plans submitted within the \$100,000 appropriation.

A copy of the complete circular can be had by addressing Secretary Isaacs.

HUNTSVILLE, TEX.-Plans are wanted at this place, until February 13, for a courthouse for Walker County, to cost \$22,500. Address J. M. Smither, County Judge.

GEORGETOWM, TEX.—Plans are wanted at this place, until February 13, for a jail and jailer's residence. Address W. M. Key.

TAMPA, FLA.—Plans are wanted at this place, until February 7, for a jail, to cost \$15.000. Address W. F. Givens, of Jail Committee.

MERRILL, WIS.—Plans are wanted for a city hall building. Ad ress the City Council.

BUFFALO, N. Y .- Plans are wanted in this city for a Masonic temple, to cost \$150,000. No date specified. Address R. H. Bickford, of the Masonic Temple Building Committee.

JOLIET, ILL.-Plans are wanted for a new Address the City Hall Building city hall. Committee.

BUFFALO, N. Y.—Plans are wanted for numerous school buildings, the total cost of which will be \$250,000, to be erected in the city. For details address Mr. Crocker, Superintendent of Schools.

FINDLAY, O .- Plans are wanted for a church edifice for the United Brethren Church Society.
Address the Rev. J. G. Radabaugh, pastor.

CHATTANOGA, TENN.—Plans will soon be wanted for a Catholic church. The details can be had by addressing the Rev. Father Walsh, rector.

SIOUX CITY, IOWA.—Plans are wanted here for a \$25,000 church for the Congretional Society. For details address T. J. Stone, of the committee to secure plans.

LAKE VIEW, ILL.—Plans are wanted for a church for the St. Peter's Episcopal Society. Address the Building Committee.

NEENAH, WIS.—Plans are wanted for a \$10,000 school building. Address the School Board.

TRADE CATALOGUES.

HENRY R. WORTHINGTON, New York, has recently issued a new general catalogue illustrating the Worthington steam-pumping machinery, independent condensers, and water-meters manufactured by him. The illustrations are fine specimens of wood engraving. Pumps for apparently every duty seem to be illustrated in its pages. It will be sent gratuitously to these interested in its pages. It those interested.

For works for which proposals are requested see also the "Proposal Column," pages i-v-vii-viii-144.

Persons who make any use of the information they not in these columns we trust will not omit to mention HE Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and relable news for our "Contract ng Intelligence." Information of importance sent to us exclusively, and not eisewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

MONTGOMERY, ALA.—The Committee on Sanitation has submitted the report of Mr. Rudolph Hering. C. E. The report suggests that that portion of the city at the foot of the ridge be sewered with plain sewer-pipe. He does not recommend any special system, allowing roof-water to enter or not at the discretion of the council. He recommends the diameter of the pipes to be eight inches. As to the depth of the sewers he advises them to be at least twelve feet deep in order to give ample draininge to the buildings. Outside of this area the depth could be six or seven feet. Manholes or shafts leading down to the pipe from the street surface large enough for a man to enter are desirable in order for a man to go down into sewers and remove the obstructions. He recommends that they be placed at the in-tersection of every street, and that flush-tanks be built at the highest ends of the sewers and be suddenly discharged in order to keep pub lic sewers clean and free from stoppage. The best pipe of the best material should be used and an inspector should be constantly present under the direction of the City Engineer to see that nothing but first-class material should be used. The supplement report of Mr. Hering will be submitted as early as practicable. It will give full and complete estimates of the cost of giving that portion of the city of Montgomery north of the ridge a complete system of sewerage.

LANCASTER, PA .- Extensions are to be made to the water-works in the shape of a 60-foot culvert which is to be built under the Pennsylvania Railroad tracks to connect the new water-works and the reservoir.

WHEELING, W. VA .- An improvement is to be made to the water-works in the shape of additional valves and machinery that will permit of pumping water directly into the mains without sending it to the reservoir. The water-works superintendent has charge of the

BRISTOL, TENN.-Howard Murphy, C. E., of Philadelphia, has submitted his report in regard to a system of water-works, which states that \$90,000 should be expended on the system. Official action matter at an early date. Official action is to be taken in the

GA. — Concerning CARTERSVILLE. water-works question here, our correspondent writes as follows: "The city authorities have appointed committees to look into the probable An engineer has been employed to get up information. Legislative enactment is necessary to get a vote upon the question as to necessary to get a vote upon the question as to whether they will be built or not, which will be had in November. Election will follow immediately after passage of act. Bonds will be issued to cover cost. There is little doubt but what the works will be erected. The committee, W. C. Baker, D. W. K. Peacock, and Charles McEwen, are hard at work, and will confer with engineers, etc."

ROCHESTER, PA. — A. W. McCoy, City Clerk of this place, writes us, under date of January 24, as follows: "A contract for construction of water-works for this place was let yesterday to Ellis Morrison, of New Castle, Pa., to be completed by January 1, 1889."

KUTZTOWN, PA.—Concerning the waterworks project here our correspondent writes as follows: "The water matter is very quiet.'

WOODBERRY, MD .- The Consumers' Water and Illuminating Company of Baltimore has awarded the contract for building the water and gas works at this place to George B. Morton at about \$200,000.

VASSAR, MICH.—The water-works question is being agitated here.

SCRANTON, PA.—William Connell, of the Meadow Brook Water Company of this place, writes us as follows concerning the intentions of the company: "We have formulated no positive plans as yet."

CRESTON, IOWA. - Concerning the waterworks question here, our correspondent writes "Franchise for water works has been granted to William S. Mercer & Co., of New York; the city takes 80 hydrants at an annual rental of 4.500. The franchise granted a year ago to ames Gamble, of New York, expired by limitation.

WACO, TEX.-Concerning the renewal of the water-works contract here, our correspondent writes as follows, under date of January 18: "Our City Council met last night as a committee of the whole and have made a contract, or agreed upon one, to be submitted to the Waco Water Co. If they accept it will run for ten years, and we will not have to bond for a new system then. Can't say what coun-cil will do if they fail to trade."

BOWLING GREEN, O.—Our correspondent writes as follows concerning the terms, etc., of the recent water-works contract: "The village has entered into a contract with Ferris & Halladay, of Jersey City, for the construc-tion of water-works here, they owning the works, and the city paying them an annual rental for the hydrants; the contract is for 30 rental for the hydrants; the contract is for 30 years, with the privilege reserved to the city to purchase the same at any time after ten years; the vote taken on Monday, January 16, to ratify the contract resulted in the ratification of the contract by the following vote: to ratify the contract, ayes, 38; nays, 116. The works contemplate! will cost about \$60,000."

MARION, VA.-Our correspondent writes: "A contract to construct water-works at this place was let to the Glamorgan Co. Lynch-burg, Va., on the 29th of December last, who commence work about the 20th of March.

JAMAICA, N. Y.—The village trustees have formally accepted the water-works constructed by the Lockwood Company, and the introduction of water will take place at once. The works embrace several miles of pipe, about fifty hydrants, and a stand-pipe with a capacity of 600,000 gallons.

GALVESTON, TEX.—The bids for artesian well, opened January 19, were all rejected, and new proposals will be advertised for.

GREFNSBORO, N. C.-Mayor R. R. King writes: "The contract for water-works has been awarded to W. W. Taylor and Charles Hindman, of Philadelphia, Pa., and Frederick B. Hubbell, of Baltimore, Md.

LINDSBORG, KAN .- Concerning the waterworks project here our correspondent writes as follows: "This question is being agitated by our citizens generally, but no permanent step has been taken as yet. There is no doubt but what our city will get water-works

SEAL HARBOR. ME.-Concerning water-works project here our correspondent writes as follows: "The Seal Harbor Water Company was organized last spring with a capital stock of \$10,000, and this winter they have been taking subscriptions for stock. At the last meeting the hope was expressed that we should have water from Jordan's Pond for next summer's use. There will nothing definite be done before March 28, when the Presiite be done before March 28, when the President, Hon. Samuel F. Barr, formally of Harrisburg, Pa., will give us some definite plan of action. It is proposed to put on an engineer to determine how and where, and what size of main will be needed, and get all the preliminaries done ready to go to work when all the rest is fixed."

OCCNTO FALLS, WIS.—Concerning the reby the Falls, wis.—Concerning the report that water-works were to be erected here by the Falls Water Power Company, the representative of the company writes us as follows: "We are not putting in water-works, but improving a water-power."

NEW YORK CITY.—At a meeting of the Aqueduct Commissioners held January 25, the Commissioner of Public Works was directed to prepare contracts for the sinking of Shaft 24 down the necessary depth.

TROY, ALA.—Concerning the report that water-works were to be erected here, our correspondent writes as follows: "No steps have yet been taken. Troy has a small engine and pumps answering a temporary purpose, and no improvement will probably be made this year." made this year.

ST. Louis. Mo.-New water-works build. ings are to be constructed in this city, the details of which can be had by addressing the City Engineer.

AUTAUGAVILLE, ALA.—According to reports Messrs A. M. Smith and James Munn will erect a water-works system here.

WEST BAY CITY, MICH.—It is reported that a sewerage system is to be constructed here at an early date.

CARTERSVILLE, GA.—It is reported that the City Council has instructed a committee to employ an engineer to make surveys, esti-mates, etc., for a water-works system.

READING, PA.—The City Council has appriated \$20,000 for the construction of ad-

ST. JOSEPH, Mo. - About \$500,000 will be expended on the sewerage system spring. Address the City Engineer.

ELLICOTTVILLE, N. Y .- It is reported that a system of water-works will be established

GLENWOOD, IOWA.—It is probable that water-works will be erected here. BURRULLVILLE, R. I .- The water-works

question is being agitated at this place. Avon, N. Y .- It is reported that this place is to be furnished with water from Conesus

BRIDGES.

WAUTOMA. WIS.—It is reported that a bridge is to be erected at this place by the County Commissioners.

TOLEDO. O .- In reference to the report that Thomas R. Wickenden, the City Enginer, writes: "Nothing further than prepartion of plans; are awaiting the arrangement of financial matters."

LAUREL, DEL.-Concerning a report that LAUREL, DEL.—Concerning a report that the Pennsylvania Railroad was to erect a bridge here our correspondent writes: "The Pennsylvania Railroad has taken no steps yet that I know of to construct a bridge at this place, but it is badly needed and it is hoped that they will do so shortly. The Government has expended quite a sum in dredging above it and the way the bridge is it obstructs navigation."

SALMON FALLS, MASS .- Concerning the report that a bridge was to be erected here, our correspondent writes: "The town has taken no action. It is understood that a bridge will be built in the spring by the Fairfield Paper Company for its own accommodation in getting across the river. For further particulars in regard to the matter address the company. Salmon Falls, Mass."

NAVESINK, N. J.—Concerning the reported project to erect a bridge over the Shrewsbury at this place, our correspondent writes as follows: "As yet there have been no steps taken further than framing a bill to be presented to the Legislature of our State; said bill, I think. white, who resides at Oceanic, N. I., and William E. Andrews, of Navesink, N. J., are the gentlemen who will have said bill introduced."

HARTFORD, CONN.—Concerning a report that a bridge was to be erected, our correspondent writes as follows: "The city and railroads join in changing grade crossing at Asylum Street so that the railroads go over the high-way. A year ago the railroads were ordered by a special commission to do the work, and they contracted with the Berlin Iron Bridge Company for two double-track plate-girder bridges, 70 feet clear span, to carry the tracks over Asylum Street."



WHEELING, WEST VA .- The citizens of WHEELING, WEST VA.—The citizens of Ohio County have been asked to subscribe \$300,000 capital stock of the Wheeling and Harrisburg Railroad Company for the construction of a union railroad bridge across the Ohio River, with terminals at Martin's Ferry, O, and the northern part of the city of Wheeling, and the question of the appropria-tion of said amount tor the purpose specified will be submitted to the voters of the county February 4 for ratification or rejection. correspondent writes concerning the project as follows: "That the subscription will be voted I have no doubt."

BUFFALO, N. Y. - It is reported that repairs are to be made to numerous bridges in this city. Address the City Engineer.

STEUBENVILLE, O.—Engineer Tschirgi is drawing plans for a bridge to be erected here. It will be of iron and the main span will be 500 feet wide. Address him, at this place, for particulars.

JERSEY CITY, N. J.-The New Jersey JERSEY CITY, N. J.—Ine New Jersey Central Railroad Co are to have a new depot and train sheds. The architects are Messrs. Peabody & Stearns, of Boston; New York Office, Mills Building. Contracts are soon to

CHICAGO, ILL.--Press dispatches state that Major T. H. Handbury, in his report 10 Congress, says that over the stretch of eleven and one half miles, between Lake Michigan Hammond, Ind., there are ten railroad and five wagon bridges, which will prove obstructions to commerce unless reconstructed. "It is expected," he adds, "that in future the river will be taxed to its full extent, even when it is widened to 200 feet, as is contemplated. Therefore it is deemed necessary to reconstruct the bridges so as to leave a clear opening of sixty feet on each side of the

RAILROADS, CANALS, ETC.

ALTAMONTE, KY .-- The Altamonte Coal Company will, it is reported, construct a dummy line.

WILMINGTON, N. C.—It is reported that E. K. P. Osborne, of Charlotte, is at the head of a scheme to build a street railroad here.

LEEDS, ALA.-Stewart & Pickett are at the head of a scheme to establish a street railroad.

GAS AND ELECTRIC-LIGHTING.

BUFFALO, N. Y .- It is reported that the Thomson-Houston Electric-Light Company will erect a building for its plant in this city, to cost \$40,000.

RALEIGH, N. C .- The Raleigh Lighting, Heating, and Power Company has been inco porated; capital stock, \$25,000. Morse, and others, incorporators. capital stock, \$25,000. George J.

UTICA, N. Y .- The Utica Electric Light Company has been incorporated; capital stock, \$150,000. Henry D. Pixley, and others, in-\$150,000 corporators,

HARRISBURG, PA .- The Harrisburg Electric-Light Company has increased its capital stock from \$1,00,000 to \$150,000, and will make extensive improvements to its plant.

DECATUR, ALA. - It is reported that Chicago, Ill., parties are to erect \$200,000 gas-works and that the Decatur Land Improvement and Furnace Company can give information.

SAN FRANCISCO, CAL.—The Standard Gas Company will erect extensive works at North Beach. Address the president.

BALTIMORE, MD.--The Edison Electric-Light Company, of Baltimore, has been incorporated. It proposes to light streets, resiporated. It proposes to ngitt streets, residences, and other buildings, and provide motive power for machinery. The company intends to place all its wires under ground.

MARSHFIELD. WIS .- It is reported that an electric-light plant is to be established here.

ANAHEIM, CAL. - The streets of this place are to be lighted by electricity.

FORT SMITH, ARK.—The plant of the Fort Smith Gas Company is to be greatly enlarged, and a better service established. Several miles of additional supply pipes will be laid, which will penetrate present unoccupied territory, and the capacity of supply will be increased at least fourfold. For particulars address P. R. Davis, President of the comBELLAIRE, WEST VA.—An electric light company has made application to the town officials, asking for a franchise to light the public streets, etc.

WHEELING, WEST VA. -- A new company wheeling, west va.—a new company has been organized to pipe natural gas to this city. The gas will be taken from wells in Washington County, and the pipe line will be twenty-four miles in length.

STREET WORK AND PAVING.

SAN FRANCISCO, CAL.—The Board of Supervisors are considering the question of expending several thousand dollars on street improvements. Address the president of the board for particulars.

PUEBLO, COL.—The City Council has decided to commence work at once upon the levees on the east side of the Arkansas River running through the city. They will cost about \$10,000 and will include a fine boulevard along the river.

BIDS OPENED.

St. Paul, Minn —The following proposals ST. PAUL, MINN—The following proposals for s'eam heating at the new jail have been received by the Police Commissioners of this city: E. T. Sykes & Co.. \$1,340; F. F. Martin, \$1,344; Haxtun Steam Heating Company, \$1,590; Porter Steam-Heating Company, \$1,650. The contract was awarded to E. T. Sykes & Co.

LITTLE ROCK, ARK.—Contracts for the first division of the City Electric Railway, have been let to R. F. Wilson, of Chicago, at the following prices: Tram rail per ton, at the following processing grading, 50c. per cubic yard. Hauling and delivering material, iron, 85c. per ton; ties, etc., 85c. per 1,000 feet B. M. Track-laying, ballasting, etc., per mile, \$375, T rail per ton; grading, 19½c. per yard. Hauling and de-livering material, iron, 80 cents per ton; ties, etc., 80 cents per 1,000 feet B. M. Track-laying per mile, \$325. For macad-amizing the tracks and two feet on the outside, \$300 per mile. Rock excavation, per yard, \$1.60. Trestling and trench work per yard, \$1.60. Trestling and trench work, per 1,000 feet B. M., \$12. Taking up and relaying block pavement, \$1.50 per square yard. Contract for tees awarded to S. V. Hafer, Little Rock, Ark., at \$12 per 1,000 feet B. M.

WILLIAMSPORT, PA .- Bids for sewers in on the 18th inst., with the following results: Gale & Myers, Washington, D. C., \$153,951.-71; J. I. Coogan, Bergen Point, N. J., \$116,-102.40; Clark Excavating Co. Elmira, N. Y., \$113.835.30; Jacoby & Madden, Bridgeport, Conn., \$105.887.35: Costello, Nagle & Co., Elmira, N. Y., \$100.622.07; B. J. Coyle & Co., Washington. D. C., \$93,233.88. Engineer's estimate \$114 487.22.

LIMA, O .- The Lima Electric Light and Power Co. has received the contract for lighting the city at an annual cost of \$6,000.

DOVER, N. J .- The following bids for lighting public streets have been submitted to the Common Council: Dover Electric Light Co., 20 incandescent lights of 20, 30, 40, or 45 candle-power, at the rate of one cent per hour for each candle-power, the price not to exceed 15 cents a lamp per night. John Maher, Philadelphia, Pa., proposed to put in an electric-light plant without any guarantee from the town, and, if the light proves satisfactory, to enter into contract to light the town. The cost of arc lights would not exceed 40 cents per night for each lamp of 2,000 candle-power, and one cent per hour for each incandescent and one cent per neur for each incandescent light of 16 candle-power. Maher also proposes, in consideration of the franchise, to supply the town with two arc lights free of charge. The bids were referred to the Committee on Street Lighting.

BROOKLYN, N. Y .- Synopsis of bids opened January 18 for repairing the turning gear of Hamilton Avenue Bridge: Norman Hubbard, work complete, \$3,250.

DALLAS TEX. -The contract for constructing water-works here has been awarded to Michael Lally, of Detroit, Mich., at a cost of 50,000. The Holly system will be used see and distribute the water. The work \$450,000. The work to be done requires the building of two reseror two reservoirs, the furnishing and laying of pipe, setting of hydrants, etc., and the construction of an engine house. The pipe and materials, excep those to be furnished by the Holly Company, have not yet been engaged.

GALVESTON, TEX .- The Board of Commissioners to construct the new water-works for the city has awarded the contracts aggregating about \$400,000. The Knowles Steam Com-

pany, of New York, was awarded the contract for two engines, with 3,000,000 gallons capacity per day. Gordon & Maxwell, of Hamilton, O., the boilers; R. D. Wood & Co., of Philadelphia, the pipes and castings; contract for laying the pipes, Merigold & Co., Lima, O.; stand-pipe and tanks to Moffett, Hodg-kins & Clarke, Watertown, N. Y. The con-tract for valves, Eddy Valve Company, Water-ford, N. Y. The plant embraces forty-one miles of pipes. All bids for artesian wells were rejected and new bids will be advertised. The commissioners have reserved \$50,000 for artesian wells.

COLUMBUS, O .- Synopsis of bids for furnishing the Ruttan-Smead System of steam-heating for three school buildings, opened January 19 by the Board of Education: January 19 by the Board of Education: Isaac D. Smead & Co., Toledo, O., \$2,765, \$1,843.33, and \$1,843.33. No other bids.

MOUNT MORRIS, N. Y .-- Synopsis of bids for furnishing cast-iron pipe, hydrants, special castings, etc., opened January 20, by cial castings, etc., George W. Phelps:

Warren Foundry and Machine Co.. New York City, 6 and 8 inch pipe, net tons, \$32.20, at Mount Morris.

Buffalo Cast-Iron Co., Buffalo, N. Y., 4inch pipe, net tons, \$34.60, at Mount Morris,
John Fox, New York City, 4, 6, and 8 inch pipe, net tons, \$32, average size pipe, net tons, \$34, at Mount Morris,
M. J. Drummond, New York City, 4, 6,

and 8 inch pipe, gross tons, \$33.33, at Mount

McNeil Pipe & Foundry Co., Burlington, N.J., 4, 6, and 8 inch pipe, gross tons, \$31, at Mount Morris.

Donaldson Iron Co., Quincy, Pa., 4, 6, and 8 inch pipe, net tons. \$30, at Mount Morris. Addyston Pipe & Steel Co., Cincinnati, O.,

6. and 8 inch pipe, net tons, \$31.50, Cairo, Mich.

Detroit Pipe and Foundry Co. Detroit, Mich., 4, 6, and 8 inch pipe, net tons, \$27.95, Cairo, Mich.

Reading H. M. Co., Reading, Pa., 4, 6, Reading H. M. Co., Reading, Pa., 4, 6, and 8 inch pipe, net tons, \$30, Cairo, Mich. Collins & Humphrey, Pittsburg, Pa., 4, 6, and 8 inch pipe, net tons, \$28,60; hydrants, \$26 each; front jackets, \$3 25 each. Builders' Iron Foundry, Providence, R. I., special castings, 2c. per lb. Eddy Valve Co., Waterford, N.Y., hydrants, \$26 each; valves 2, inch \$2. 4 inch \$8 ac. 6

\$26 each; valves, 3-inch, \$7; 4-inch, \$8.25; 6 inch, \$14.25; 8-inch, \$21.

AVELON, N. J .- The contract for building new hotel at this place has been awarded to E. R. Williams, of Cape May, for \$35,000.

MINNEAPOLIS, MINN. - Proposals for furnishing water-pipe materials have been opened by Council Committee on Water-Works as

Harry McAmy, 21/2 cents per pound, with a discount of 1 per cent; Thomas Mullaly, 2½ cents, less 1-10 of 1 per cent; Smith, Richardson & Swartz, 2.37½ cents; Lockman, Upton & Co., 2½ cents less 1-10 of 1 per cent.; North Star Iron Works, 23/2 cents. less ½ per cent.; Crown Iron Works, 2.95 cents; Northwestern Foundry, 2½ cents. The committee will recommend that the contract be given to McAmy, as his was the lowest bid.

GOVERNMENT WORK.

WASHINGTON, D. C .- The following bids were opened January 10 at the office of the engineer of the sixth lighthouse district for material, etc., for the revetment and jetties for the shore protection of the Cape Canav

eral, Fla., light station:
Stemmever Lumber Manufacturing Company, Charleston, S. C, lot No. 1. lumber,

\$1.597.95.
Bailey & Lebby, Charleston, lot No. 2, hardware, \$174.65 (accepted); lot No. 3. steam-pumps, boilers, etc., \$610.10 (accepted), C. S. Pitcher, Charleston, lot No. 2, \$203,-

C. S. Pitcher, Charleston, 192 40; lot No. 3, indefinite. Cameron & Barkley Company, Charleston, lot No. 2, \$206.36; lot No. 3, \$695.90. The bid of the Stemmeyer Lumber Com-pany was rejected. All of lot I will be pur-

WILLET'S POINT, N. Y .- Synopsis of bids for plumbing and carpentry work for fourteen public buildings and sets of officers' quarters, o ened January 23 by Captain C. P. Miller, Corps of Engineers, U. S. A.: James L. Lowry, New York, \$6,332; John Spence, New York, \$5,795; George Cody,

\$5,780; Christopher Nally, New York, \$6,895; Dixey & Dovey, Philadelphia. Pa., \$4,355; Lewis & Young, Flushing, N. Y., \$6,033; Thomas Elliott, Flushing, N. Y., \$6,0633; James F. Darmour, Flushing, N. Y., \$5,476.

WASHINGTON, D. C .- The following bids were opened at the office of the Inspector of the Third Lighthouse District January 13 for opened at the office of the Inspector of 275 stone sinkers:

James Scully, Groton, Conn., \$1,378.75. Accepted.

Charles F. Stoll, New London, Conn., \$2,-107.80.

Bodwell Granite Company, Rockland, Me., \$2,025.

PROPOSALS.

(Continued from page viii.)

TOOLS.—Proposals are wanted at Washington, D. C., until March 1, for furnishing tools and materials for the Navy Yard, at Portsmouth, Va. Address the Secretary of the Navy.

STEEL BOILERS.—Proposals are wanted at Nash-ville, Tenn., until February 2, for furnishing and erecting six steel boilers, 66 inches in diameter and 18 feet long. Address George Reyer.

RAII.WAY.—Proposals are wanted at New York City u-til March 5, for constructing a net of railways in the Island of Puerto R co. Address Miguel Suarcz, Consul-General of Spain, New York City.

COURT HOUSE.—New proposals are wanted at Liberty, Mo., for the erection of a court-house; no date sp-cified. Address County Clerk.

DREDGING.—Proposals are wanted at New York City until February 6, for dredging at Pier 7. East River; engineer's estimate about 20,000 cubic yards. Address the Department of Docks, Pier 1, N. R.

STREET IMPROVEMENTS. — Proposais are wanted at Mad-sonville, U., until February 4, for street work. Address James Griffin.

STONE JAIL .- Prop sals are wanted at Georgetown, Tex., for the erection of a stone jail \$30,000. Address the County Commissioners.

BRIDGES.—Proposals are wanted at Kansas City, Mo., for the construction of nine budges; no date specified. Address County Clerk Eurr.

CAST-IRON PIPE.—Proposals are wanted at Toledo, O., until February 7, for furnishing on beard cars in that city the following approximate qualities of water-pipe—v'z.: 75 tons of 12-inch, 20 tons of 8-inch, 146 tons of 6-inch, and 12 tons of 4-inch. The ton used shall b-2,000 pounds. Address 11 C. Cotter, Superintendent Water-Works.

RAII ROAD WORK.—Proposals are wanted at Richmond, Va., until February 10, for the clearing, grubbine, grading, masoniy, bridging, tresting, crossites, and track-laying on the part of the Oxford and Clarksville Ruilroad between Oxford. N. C., and Durham, N. C. Address R. H. Temple, Chief Engineer, P. U. Box 224, Richmond, Va.

GASOLINE LIGHTING.—Proposals are wanted t Concinnatt, O., until February 3, for lighting by assume the streets of the city for a period of one ear, according to specifications. Address Edward lenderson, City Clerk.

ARTESIAN WEI.I..—Proposals are wanted at To-ledo, O., until February 6, for boring an artesian well. Address (v. H. Cole, City Clerk,

LIGH FING STREETS.—Proposals are wanted at Marysville, O, for lighting the public streets by gas or electricity. No date specified. Address the City Clerk.

SCHOOL BUILDING. - Proposals are wanted at Biddeterd, Me., unt I February 11, for the erection of a brick high school building. Address Levi W. Stone, of the Building Committee.

IRON BRIDGE.—Proposals are wanted at Washin, ton, La., until February 10, for the construction of an 'ron draw-bridge. Address Leon Wolff, P. O. Box 27, Washington, La.

TRUSS BRINGE.—Proposals are wanted at Vernon, Ind., ut til Feoruary 6, for the construction of a Howe truss bridge. Address J. C. Cope, County Commissioner, Vernon, Ind.

PIFRS AND ABUTMENTS. — Proposals are wanted at Vernon, Ind., until February 6, for building two piers and two abutments. Address J. C. Cope, County Commissioner, this city.

WATER-WORKS.—Proposals are wanted at Brisne construction of a complete system No date specified. Address Mayor

PUMP, BOILER, ETC. -- Proposals are wanted at Morrisburg, Ontario, Can., u. til February 6, for furnishing a steam-pump, boiler, and smoke-stack for the water-works. Address F. F. Plantz, Village Clerk.

IRON BRIDGF.—Proposals are wanted at Elk City, an., for the crection of an iron bridge. No date see fied. Address H. Woodring for details.

WATER-WORKS.—Proposals are wanted at Green-ville, Tex., for a complete system of water-works. No date specified. Address the Water-Works Committee.

PI.UMBING AND GAS PIPING.—Proposals are wanted at Washington, D. C., until February 21, for furnishing all the mater als and tools and performing all the labor necessary to put in place complete the system of plumoning and gas piping required for the court house, post office, etc., building at New Albary, Ind. Address Will A. Freret, Supervising Architect. Digitized by

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippines and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apart neith-house; ten, tenement; c, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

404 E 14th st, br sts and warerooms; cost, \$35,000; o, W C Doscher; a, H G Knapp & Co.

57-50 E 86th, br flat; cost, \$45,000; o, Ed Kilpatrick; a, Dan Burgess.

205-207 F. 48th. 2 br flat; cost, \$40,000 all; o, Fred Shuck; a, Ed Wenz.

406 West 52d. br dwell and store; cost, \$12,ooo; o, Hustin & Corbit; a, C Abbott, French & Co.

Secor 2d av and 88th, 4 br tens and stores; cost. \$55,000 all; o, Wm Knapp; a, A B Ogden & Son.

Ss 88th, 62 e 2d av, 6 br tens and stores; cost, \$77,000 all; o and a, as above.

744 Ninth av, br flats and stores; cost, \$23,-000; o, Charles Cohn; a, Hugo Keller.

N s West 12th, 100 e 10th av, br store; cost, \$7,000; o, J J Asior; a, not given.

N w cor West End av and 81st st, 7 br dws;

st, \$119,000 all; o, E A Watkins; a, Lamb & Rich.

195 and 197 Canal, br store; cost, \$50,000; o, Amos Morrill; a, Albert Wagner.

777 Second av, br store and flats; cost, \$19,-000; o, Sam Kampner; a, Fred Ebeling.

339-345 E 74th, 4 br tens and offices; cost, \$48,000, 0, Philip Brandner; a, Frank Wen-

Rear of above, br factory; cost, \$26,000; o and a, same as above.

ALTERATIONS-NEW YORK.

S e cor Park av and 17th, br hospital; cost, \$45,000; o, German Hospital; a, De Lemos & Cordes.

305 West 54th, club room; cost, \$6,500; o, Turn Verin, Bloomingdale; a, Jas Wolf.

BROOKLVN.

McDonough st, s s, 80 w Throop av, 4 b s dwells; cost, \$11,000; o, a, and b, John Fraser.

S s Myrtle av, 125 e Hamburg av, 2 fr dws; cost, \$10,000 all; o, Gus Loeffeler; a, Th Engelhardt

S s McDougal st, 138 e Howard av, 2 fr dws; cost, \$8,000 all; o, Susan E Nichols; a, C W Cowan

W s Nostrand av, 347 n Park av, fr dw; cost, \$10,000; o, Lewis and Fowler Mfg Co; a, A W Dickel

BUILDING INTELLIGENCE. BROOKLYN-ALTERATIONS.

N W cor Washington and Johnson sts, br bldg; cost, \$10,000; o, W A Hustead; a, J S Glover

MISCELLANEOUS,

WASHINGTON, D. C.—1228-1234 H, N E, 4 2 story bldgs; cost, \$10,000; o and a, N I Haller.

Cor 7th and South, N W, 6 2 story bldgs; cost, \$12,000; o and a, Charles Gesstord.

1223-1229 E, N W, 4 2 story bldgs; cost, \$12.000; o, Conrad Becker; a, J Germuller; b, Mr Sweeney.

59 permits less than \$7,000 in four weeks. PHILADELPHIA, PA.—17th and Penna Railroad, 2 story br pipe factory; o, The Penna Pipe Mfg Co.

Mentzer, below Pine, dwell; b, Fitzgerald

BALTIMORE, MD.--Park av and Lex, 5 story br and stone bldg; cost, abt \$40,000; o, Emanuel Greenbaum; a, C L Corson.

Myrtle av, beg at Hoffman, 4 3 story br and stone bldgs; o, Shannon Bros.

BRUNSWICK, GA.—A \$20,000 opera house is to be erected here from plans which are already completed.

JANESVILLE, WIS.—The Janesville Hospital Association will erect a \$200,000 edifice.

ATLANTA, GA.—Address Mrs S M Inman for details of \$25,000 hospital to be erected by the Franklin Association.

APPLETON, WIS.—The trustees of Law-rence University will erect a ladies' hall, to cost \$20,000.

PITTSFIELD, MASS. — Address Byron Weston for details of large s ock house to be erected here.

SAN ANTONIO, CAL.—A company has been organized in this city to erect a hotel, to cost \$200,000.

CHICAGO, ILL.-128-130 Franklin, brick additions to stores; cost. \$12,000; o. Mr Hill; a, L Gustaf Haliberg; b, A Carlson

1235-1239 Wabash av, brick addn. cost, \$10,000; o, H T Page and E F Waite; a, Wm Drake; b, Win Pond & Son

Grove near 22d, addn to elevator; cost, \$22,000; o, Geo A Seaverns; a, Jno Doble; b. owner

2933-2939 1/2 Keeley, br flats; cost, \$11,-000; o, Jas Mahr; b, A H Lowden

1559 Milwaukee av, br st and flats; cost, \$10,000; o, Fred Kroschevits; a, H Kley;

12 buildings costing less than \$7,000

BUILDING INTELLIGENCE.

- JAMESTOWN, DAK.—The sum of \$50,000 will be expended on the erection of a Government industrial school building.
- ST. JOSEPH, MO. A hotel, to cost \$125.ooo, is to be erected here by Dr Geiger from plans by Messrs. Eckel & Mann.
- SAVANNAH, GA.-Liberty and Jefferson sts, Stony Point natural cement brick; cost, \$16,000; o, Episcopal Orphans' Home; a, John J Nivit.

Small buildings and alterations to the amount of \$14,500.

DULUTH, MINN .- The Standard Oil Company has decided to erect iron docks at this place, to cost \$250,000

ROCHESTER, IND—A college to cost \$25,000 is to be erected here. Address the College Bldg Committee

GRAVESEND, L. I.—Several school bldgs are to be erected here. For details address Jacobus Lake, of the Building Commit-

ANNISTON, ALA.—The 12th Street Bap-tist Church of this city proposes to erect at once a stone or brick, or partly stone and partly brick church edifice, to cost \$15,-

MILWAUKEE. WIS — A new Catholic Church will be built on the West side, near Merrill's Park, at an early date; Rev P H Dorman, the pastor, can furnish details

N w cor 7th and Prairie sts, br hall; cost, \$16,000; o, Milwaukee Liedertafel Society; a, Robert Kirsh; building committee, Geo Mueller, Otto Gallun, and Paul Kulow

SPRINGFIELD, MASS.—Cor Taylor and Dwight sts. 4 story braddition, with 1-story boiler house; o, P P Kellogg

Eight buildings less than \$7,000

ALBANY, N Y—State, cor Swan st, stone dwell; cost, \$50,000; o, John G Myers; a, Ogden & Wright; b, John Snaith and M L

Norton st, br dwell; cost; \$10,000; o, G H Treadwell; a, Ogden & Wright; b, Jas. Shattuck

GEO. A. SCHASTEY & CO.,

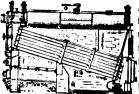
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THE FOLLOWING PUBLICATION IS NOW READY AND FOR SALE.

TITLE PAGE.

A COLLECTION OF DIAGRAMS

Representing the General Plan of

TWENTY-SIX DIFFERENT WATER-WORKS,

Contributed by Members of the

New England Water-Works Association,

And Compiled by a Committee.

1887.

NEW YORK:

PUBLISHED BY THE ENGINEERING AND BUILDING RECORD. 82 & 84 FULTON STREET.

P. O. Box 3037.

INTRODUCTION.

Office of Secretary,

NEW BEDFORD, MASS., November 1, 1887.

NEW BEDFORD, MASS., November 1, 1887.

This collection of diagrams is the result of the persistent efforts of Messrs. William B. Sherman, of Providence, R. I., and Walter H. Richards, of New London, Conn., who, as a Committee on Exchange of Sketches, have secured these drawings from members of the Association. The following extract from a report presented by these gentlemen at the Manchester, N. H., meeting in June, 1887, will explain in part the origin of the collection:

"In answer to circular letters sent out to members, there

In answer to circular letters sent out to members, there "In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three water-works represented in the Association. Having this data on hand, though crude in many particulars, it was decided to put the same into available shape for the benefit of the members. This has been accomplished by the Committee without cost to the Association. From these rough sketches—revised, reduced to uniform size of 10 by 15 inches—a set of tracings has been made, and a sample folio of blue prints prepared. This folio and set of tracings are herewith presented as forming the main part of this report."

Since the Manchester meeting three more subjects have been received and subscribtions for sets of reproductions from the

received and subscribtions for sets of reproductions from the tracings have been called for. The ready response to the call is evidence of the value of the Committee's work, and arrangements were made with THE ENGINERING AND BUILDING

RECORD for publication in this present form.

R. C. P. COGGESHALL,

Secretary, New England Water-Works Association.

Address, BOOK DEPARTMENT.

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THE ENGINEERING AND BUILDING RECORD, 82 & 84 Fulton Street, New York

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THE SANITARY ENGINEER.

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THE MUNICIPAL ENGINEERING PROB-LEMS OF NEW YORK.

THE admirable message of Mayor Hewitt, of this city, devoted to the municipal engineering and rapid-transit problems of New York, which is published in full in the daily papers of the 1st inst., will be most suggestive and instructive reading to all persons interested in municipal problems in American cities. The evils from which this community suffers, and which are so ably pointed out by the Mayor, are those which younger cities should, in a measure, be able to avoid by studying our experience. With honest pride and justifiable faith in the future of this great metropolis, he forcibly points out the imperative need of adequate dock facilities, suitable pavements, and the proper control of corpora-tions who use the streets. He devotes the larger portion of his message to the great and pressing problem of real rapid-transit facilities, the lack of which so seriously retards the growth of the

We are glad to see that he has advocated the plan, recommended by The Engineering and BUILDING RECORD in an editorial on a former occasion, that the city should pay for and own the roadways on which these rapid-transit trains shall run. He truly points out that this will secure a minimum cost for construction and proper protection for the community. The details of the plans and routes that he proposes we shall not discuss at this time, but the whole subject should add interest to our description and illustrations of the Berlin Viaduct Railway, the first portion of which we present to our readers in this issue.

BACTERIOLOGICAL WATER-TESTS.

WE have from time to time informed our readers of the progress made in testing drinkingwater supplies as to the number and character of micro-organisms present in a given sample, and have pointed out that while this mode of testing water may be in some cases a useful addition to chemical analysis, it is as yet very far from being a substitute for it. The difficulties in the way of drawing definite conclusions from the results obtained by mixing a drop of the water to be tested with some nutritive material, such as gelatin, and then counting the number and noting the character of the separate and distinct colonies of bacteria which are produced, are due to the fact that in ordinary waters, not specifically contaminated, a dozen or more forms of bacteria are likely to occur; that these have different periods and modes of development; that the growth of one may interfere with that of another, and that all of these tend to increase the difficulty of determining whether the bacteria of a particular disease, such as typhoid fever, are present in the sample. One of the first difficul-ties met with in such investigations is the fact that some of the colonies produced in gelatin cultures have the property of liquefying the gelatin, and some of them do this very rapidly. This tends to prevent the development of other colonies, or at least makes it difficult or impossible to observe and register such development, and this is the main reason why water cultures have been usually limited to three days' time. Prof. Bischof has recently made public the results of a series of experiments made by him upon means of checking the growth of the

liquefying and rapidly spreading colonies, so as to permit of longer periods of culture, and thus to give to those bacteria which require more than three days to develop a chance to show themselves.

He found the most convenient means of destroying the vitality of a colony were crystallized potassic permanganate and spongy iron, either of which will, when applied in very small quantity, check the growth of a colony, while it will not poison the adjacent gelatin, and, therefore, will not interfere with the development of another bacterium of slower growth which may happen to lie in the immediate vicinity. In the experiments made by this method culture of water samples for nine days usually showed a marked increase in the number of colonies, sometimes giving thirty times as many as were obtained by three days'culture. Even after nine days new colonies may continue to appear. This fact is interesting when taken in connection with the effects of previous storage on the number of colonies and as to the differences observed according to whether the water was stored before or after Changes of development in the filtration. micro-organisms can certainly be produced by storing the water for a longer or shorter time before testing it by the gelatin culture.

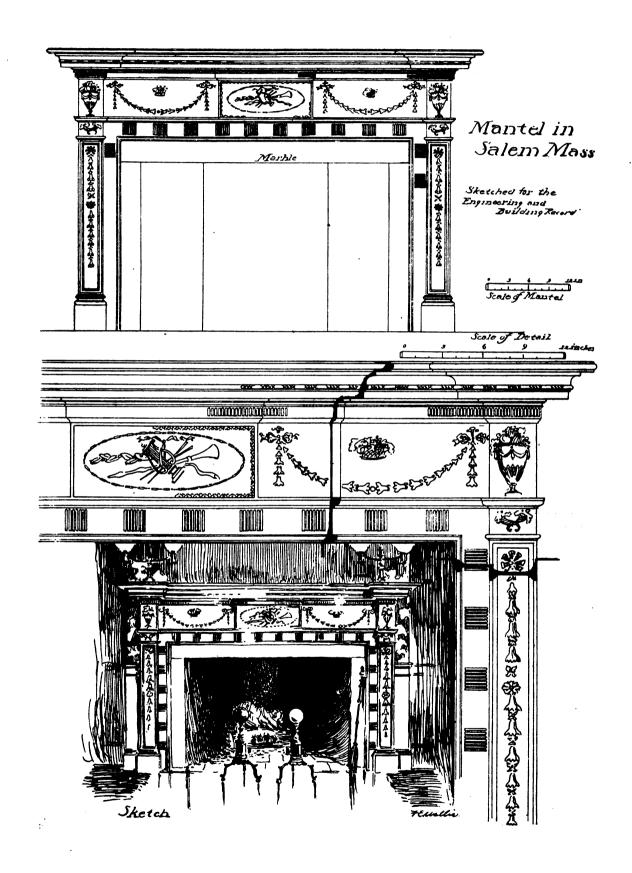
With regard to the objection that the culture tests do not distinguish between the harmless and the dangerous bacteria, it may be said that the same objection holds good with regard to the results of chemical analysis.

As a matter of fact, however, culture tests do, even with our present very imperfect knowledge, enable us to distinguish some of the dangerous bacteria if they are present. But the actual finding of the bacillus of typhoid or the coccus of erysipelas is not at all necessary to enable us to declare a given source of water-supply to be dangerous. A dangerous water-supply is not merely one which actually contains specific, pathogenic bacteria. It is one which is specially liable at times—not always—to contain such bac-This liability exists whenever a watersupply is contaminated with human excreta, and biological analysis, in the great majority of cases, is simply one means of determining whether such contamination exists. In some half a dozen cases it has been found possible to demonstrate the existence of the typhoid fever bacillus in a water-supply by culture methods, but in every one of these cases the presence of this bacillus had been practically demonstrated by the production of disease in man before the biological analysis was made. This does not prove that the method is valueless. Far from it; it rather proves that the method is one which may be relied on to furnish some good evidence that a water is contaminated with sewage, though no specifically dangerous bacteria are present in the particular sample examined, and, in the great majority of cases, this is all the evidence that is needed to indicate that special precautions should be taken in the use of such water.

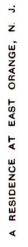
HOW TO CHECK WINTER WATER-WASTE IN NEW YORK.

GENERAL NEWTON, Commissioner of Public Works of New York, has received a report from Mr. Birdsall, the Chief Engineer of that department, in which he states that within the past four weeks 11,000,000 gallons more of water have been consumed daily than the Croton and

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THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.



Bronx River conduits are able to supply to this city. He adds that his department has no means to stop this waste, which he says is due to people allowing their taps to run in order to prevent the water freezing in exposed pipes.

We have, year after year, pointed out the necessity of some control over the location of water-pipes in buildings with a view of prevent-

ing freezing.

As yet we believe no concerted action has been taken by the Department of Public Works and the Health Board, and even if such action were taken now, it would probably not seriously affect many of the multitude of instances of exposed pipes in houses already built. This is a very serious question, and it seems as if the only practicable alternative would be to authorize the Commissioner of Public Works to have an inspection made of every building containing a water-service pipe, and wherever pipes are found so exposed as to be liable to be frozen, then in all such cases, meters should be placed on the service-pipe at the cost of the owner pending such alterations as will secure protection from frost and the consequent temptation to waste. In other words, the waste must be stopped, and the quickest and cheapest way would seem to be to put a meter on every service-pipe where there is a reasonable possibility that the water passing through it will freeze if at rest.

OUR ARC!IITECTURAL ILLUSTRATIONS.

RESIDENCE AT EAST ORANGE, N. J.—A. H. THORP.

ARCHITECT. NEW YORK.

MANTEL IN SALEM, MASS.

A NOTABLE HOSPITAL FOR MONTREAL.

A BOARD of Governors, with the Honorable J. J. C. Abbott, Q. C., as President, has been organized under a charter obtained during the last session of the Dominion Parliament of Canada, for the constitution of the Royal Victoria Hospital about to be erected for the city of Montreal through the munificence of Sir George Stephen, Bart., President and Director of the Canadian Pacific Railway, and Sir Donald Smith, K. C. M. G., M. P., also a director of the Canadian Pacific Railway and of the Hudson Bay Company. These gentlemen have given \$1,000,000 for the purpose of the foundation of the institution, and the corporation of the city has supplemented the gift by granting as a site for the new building a lease in perpetuity of a plot of land about twelve acres in extent, situated near to the north-east angle of Mount Royal Park, at an elevation of about 300 feet above the St. Lawrence River, toward which the city gradually slopes.

It is proposed that the establishment shall accommodate about 300 patients, and that in addition to the ordinary requirements of a hospital of that extent there shall be a training school for nurses, a medical school, and an outpatients' department.

Mr. H. Saxon Snell, F. R. I. B. A., of London, has requested by the Board of Governors to prepare a design and direct the construction of the building.

ARCHITECTURAL COMPETITIONS IN INDIA.

THE following letter in *Indian Engineering* would indicate that the methods pursued by the New York City authorities in the recent architectural competition for plans for the proposed municipal building in City Hall Park are not confined to this country:

"SIR: The advertisement launched forth by the Umritsur Municipality is both instructive and amusing. At first I thought it a hoax and a stupid one, of the Simple Simon type, but I am now convinced that it is intended to be clever. The municipality ask for complete 'working drawings, specification, and estimate.' for a hospital to cost Rs. 75,000 and offer a prize of Rs. 500. That is to say, they ask for Rs. 2,000 worth of work, and offer for it the magnificent sum of Rs. 500 in the form of a PRIZE! Such unbounded liberality should meet with a hearty response throughout India. Would you mind notifying that the undersigned will be happy to receive any number of dress-suits of clothes valued at 8 guineas each, and he will give upwards of 2 guineas for the suit which fits him the best, and, like the Umritsur Municipality, he will not bind himself to return the rejected suits, as they may be useful to him hereafter. Intending tailors will be furnished with full measurements on application. Now please don't all speak at once.

R. F. Chisholm."

THE BERLIN METROPOLITAN RAILWAY.
No. I.

AT this time, when the extention of our rapid transit facilities is attracting such serious attention, it may be interesting to inquire into the principal features of some of the systems that have been used abroad.

In Europe, London and Berlin have their completed systems.

The railway system of London has been well known for a long time, but there is less familiarity with the works that have been executed during the past few years in Berlin. They were planned at about the same time at which the New York Elevated Railway system was developed, but at Berlin, the considerations which led to the construction of the metropolitan road were in the first instance of a strategic nature. When the Prussian State Department took the work in hand, it did not have for its principal object the replacing of the several omnibus and street-railway lines, which were amply sufficient for a city of moderate size and comparatively small travel. It looked farther: it desired to make complete connections between the lines running to the east and those running west, in order to give a possible mobilization of the army the assurance of absolute success.

Of this Berlin Elevated Railway we give the following complete account, translated and condensed from that in the Zeitschrift für Bauwesen Herausgegeben im Ministerium der Offentlichen Arbeiten, published in Berlin by Ernst & Korn, and have reproduced, and in some instances redrawn, a number of the illustrations therein contained.

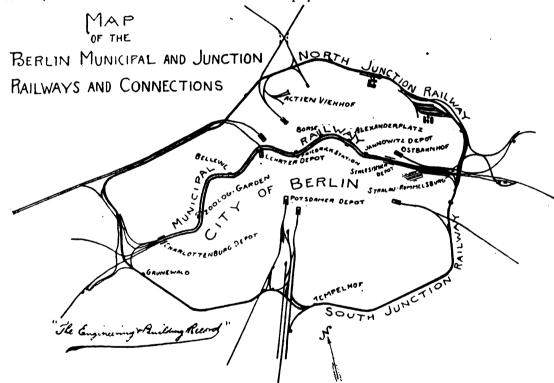
CONSTRUCTION, VIADUCT, TERMINI.

It is a sinuous line, which crosses the city from east to west, following practically the major axis of the ellipse formed by the belt-line, built some years before, which surrounds the town, connecting with all railroads which it intersects. It is separated only a short distance from the Spree River, which it crosses three times. Its length between the two termini (Schlesischer and Charlottenberg) is 12,145 metres. The radii of the curves vary from 300 to 500 metres. The grades are from 2 to 8 in 1,000.

Of the entire structure, 12,145 metres long, 7,964 metres, inclusive of depots and stopping places and stone bridges, was built as arched viaducts; 1,823 metres, inclusive of street crossings and iron bridges, was built with iron superstructure; 675 metres, inclusive of the Silesian junction depot, was built as embankments contained between retaining-walls, and 1,683 metres, inclusive of the depot Charlottenburg, was ordinary embankment.

On account of the low elevation of the tracks of only six metres above the street, no construction could be considered excepting masonry, and where exceptionally iron construction was employed local reasons were the governing causes.

The viaducts are of uniform construction, throughout excepting that the distances between the piers slightly vary. The form of the arch is always a segment of a circle. On account of the great cost of the viaduct careful preliminary work preceded the final adoption of the plans, and the piers and arches were carefully and scientifically proportioned.



The Metropolitan Road was opened February 7, 1882. Thanks to this new line, the trains can cross the capital without being broken up or traversing the line the second time, as easily as they would pass through the smallest station in the empire.

The railroad is an elevated structure crossing all streets and roads above their level. Outside of the city limits. beyond the junction depots, its tracks slope down and connect with the general railway system. Within the city limits the style of the structure was prescribed by the city authorities and it was built as an arched viaduct; the approaches at each end were embankments. At the east end, where the property was more valuable, the embankment was contained between retaining walls; at the west end it was not. It may be remarked here that the prescribed style of an arched viaduct almost invariably coincided with the interests of the railway company, as a comparative estimate of the cost of the viaduct, within the city limits, compared favorably with an embankment on account of the small amount of property to be acquired, and as between an embankment contained between retaining-walls, it compared favorably on account of the possibility of utilizing the arches of the viaduct for business purposes. The road is a 4-track road throughout. The two northern tracks are reserved for local traffic, while the two on the south are traversed by passenger trains from the trunk and suburban lines; the two services being absolutely distinct.

The engineers did not confine themselves, however, in their preliminary work to masonry construction only, but competitive plans in iron for spans of 10, 12, 15, and 21 metres were also worked out and their cost carefully estimated. These plans included: (1) Iron superstructure on wrought-iron piers; (2) iron superstructure on stone piers; (3) iron superstructure on cast-iron pipe piers. The cost of the iron structure, however, in all cases exceeded that of the masonry viaduct. For instance, for spans of 15 metres and a total height of construction from foundation to rails of 10 metres and for a width of viaduct of 141/2 metres, the cost of Plan No. 1 per lineal metre was estimated at 2,316 marks, of Plan No. 2 at 2.451 marks, and of Plan No. 3 at 2,627 marks, while the masonry viaduct of even greater dimensions only cost 1,987 marks.

The width of the viaduct as finally adopted is $15\frac{1}{2}$ metres from face to face. This width accommodates four tracks, but as it appears now it is insufficient, and does not leave room enough between tracks for employees and workmen to operate and repair the road.

Street-crossings.—The number of street and road crossings between the terminal depots is 65, and, with the exception of a few of the small lanes, which could be carried through the arched openings of the viaduct, they were constructed as iron bridges on massive masonry abutments. Many objections were raised against such an extensive use of wrought iron on account of the diffi-

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culty of producing a good architectural effect, and on account of its lack of durability, the greater cost of maintenance, and the increased noise; the lack of head-room, however, compelled its adoption. The plans were worked out with the view of producing the best possible appearance. It was insisted that the crossing should be absolutely water-tight, and that noise was to be avoided as much as possible. The style and the number of girders of the different crossings varies very much according to locality and available head-room, crossings having 4, 6, and 8 girders each respectively. The determination of the number of girders depended upon the head-room, the amount of material required, and on purely local reasons. Where there was plenty of headroom, six girders generally carried the four tracks. The six girders were divided into two systems of three girders each, braced together and carrying each two tracks. Where head room was scant eight girders, as a rule, were used, and in two cases four girders only were used. Where it was possible arch bridges were used, but

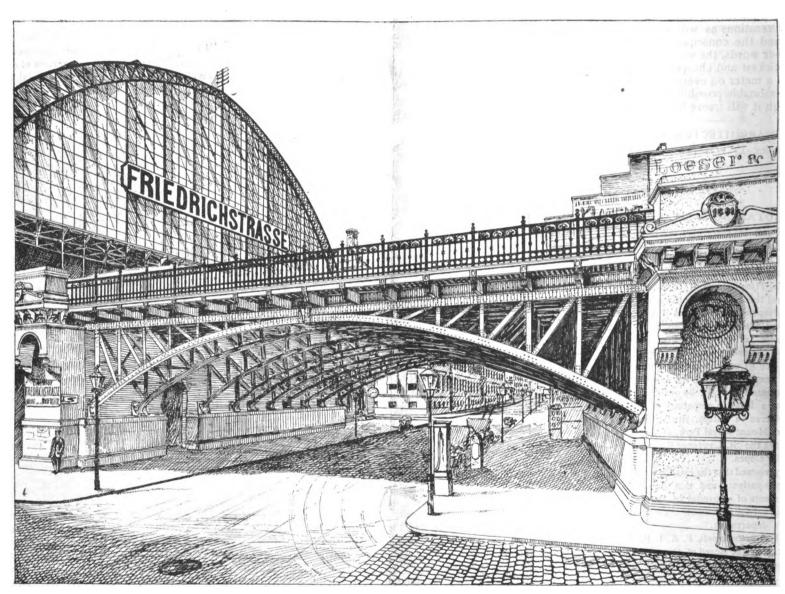
When latticed girders were used they had parallel chords and single triangular web systems, with riveted joints. Much attention was paid to the road-bed; the principal requirement was that of being absolutely watertight, and the second condition was noiselessness. Many experiments and observations were carried on for the purpose of ascertaining the causes of the noise and the mode of preventing it, and, as the result, it was found that the noise caused by trains moving over iron bridges increased in direct proportion with the length of the bridge, but there was no material difference between latticed or plate girders, and the theory that the plate webs were transmitters of the noise was not proven. Bridges which had the rails resting on wooden longitudinal sills made less noise than those where the rails rested directly on the iron superstructure. It mattered little whether the intervening wood was arranged as longitudinal sills or as transverse ties. Layers of felt or rubber between sills and cross-ties reduced the noise slightly both in wood and iron construction. The covering of iron

The buckle-plates rest upon a grating made of angleirons, and the convex side of the buckle-plates is turned downward. All buckle-plates were galvanized, the covering of zinc amounting to .55 kilos per square metre. The best zinc only, without admixture of lead, was used. In order to avoid the sliding of the gravel filling upon the buckle-plates, they were tarred and covered with sand. The roughness of the surface thus produced was sufficient to hold the gravel without interfering with drainage.

For the purpose of drainage the lowest courses of the buckle-plates were perforated with holes, connecting with a system of wrought-iron leaders. The latter connected through the piers with the sewers. All street-crossings were provided with sidewalks and hand-railings.

Painting.—All iron was first cleaned and oiled, then covered with two coats of red lead and oil in the shops, and after erection painted with two coats of paint, consisting of fifty parts by weight of white lead, fifty parts of zinc, and one part of ultramarine.

Besides the two terminal depots at Schlesischer



beam bridges predominated; both arch bridges and beam bridges were of the plate-girder type. Of the 60 bridge crossings, 52 were beam bridges and 8 arch bridges; 40 of the crossings have continuous plate-girders, resting on four supports. In beam bridges the length of span varied from 7½ to 15½ metres, with the ratio of depth to length from one-eighth to one-eleventh.

The intermediate column supports of the continuous girders were arranged as pendulum posts, with ball and socket joints under the girder and at the bases of the columns. They are mostly of cast iron; in some cases wrought-iron columns have been used and ornamented to as high a degree as the material will permit. Each column carries from 100 to 155 tons of weight. Their bearing surface on the foundation piers varies from 0.700 to 0.810 metres diameter; the columns weigh on an average 1.550 pounds and cost 269 marks.

The continuous girders resting on four supports had to be anchored at the abutments so as to transmit a negative reaction; all bearing plates are of simple form and of cast iron.

structure with a plank floor had no noticeable effect upon the decrease of the noise. A covering of the tracks with a thin layer of gravel reduced the noise very materially, but the most effective thing was a regular gravel road-bed. The quality and condition of the rolling stock had the greatest and most remarkable influence upon the quantity of noise. In accordance with the above observations, two styles of road-bed were worked out. First, longitudinal sills bedded in gravel, rested in sill-carriers. The sillcarriers were trough-shaped, and the space between the sill carriers was covered with thin buckle-plates to make the deck water-tight, and covered with a thin layer of gravel to reduce the noise. In the second plan the whole deck is formed of buckle-plates and ballasted, with the rails and rail carriers bedded in gravel. The first mode was intended to be used on straight stretches between depots and turnouts. Both plans fulfill the condition of being noiseless, but the second plan is superior to the first in respect to water-tightness. The buckle-plates could be made so light that the saving of material was quite considerable and that style of floor was generally adopted.

and Charlottenberg, the Metropolitan has eight stations. Three of them are so constructed that they are used for both the trunk line and local traffic; they are, in going from east to west, Alexander Place, Frederick Street, and the Zoological Gardens.

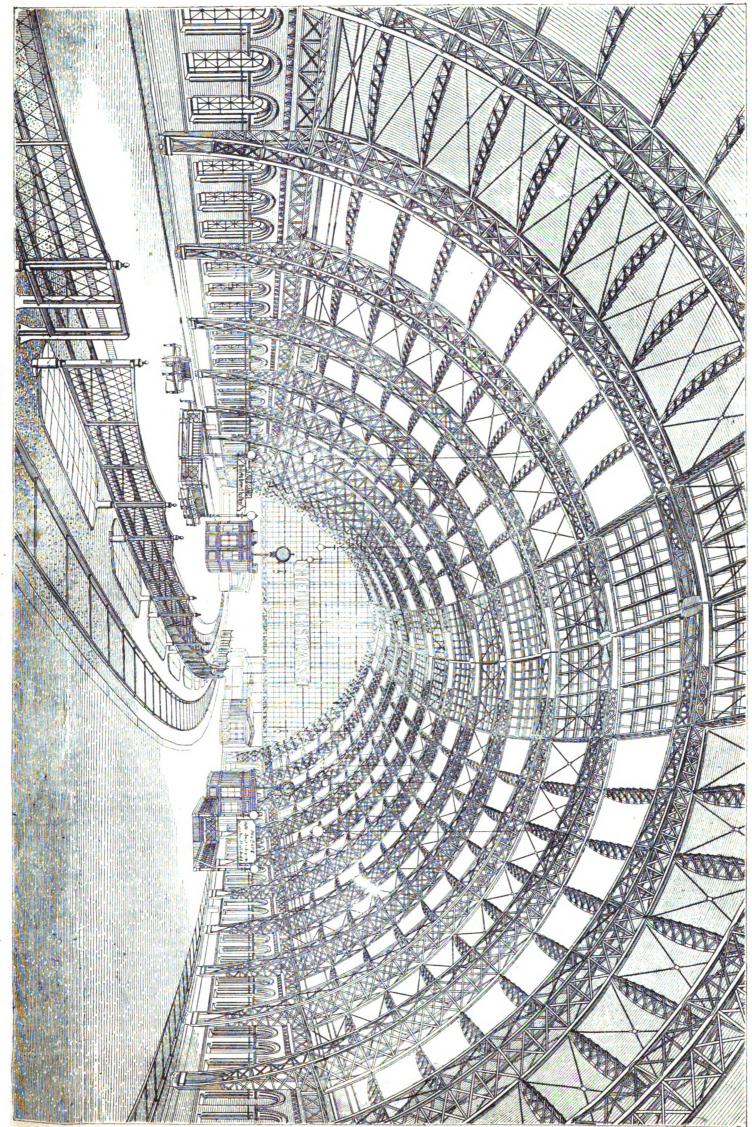
The distance between stations varies between 1.69 and 2.26 kilometres. The speed of trains between stations must not exceed 45 kilometres per hour.

All of the depots and stations are remarkably well designed. They are built of two stories. The lower story, on the street level, contains the ticket-taker's gate, the waiting rooms, the buffet, etc. Large staircases give access to the upper platform, which is on a level with the road and covered.

Baggage is only received at the stations used by the trunk lines. The baggage-rooms are also upon the ground floor, the baggage being raised to the platforms by hydraulic elevators.

The construction of the termini is of brick masonry. These bricks are partly dull and of different colors, and partly enameled upon their exposed faces, giving the archi-

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INTERIOR OF FRIEDERICHSTRASSE DEPOT.

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tecture a rather pleasing appearance, while it is, at the same time, somewhat pecular. Stone (granite and brown freestone) has only been employed very quietly, and for the sole purpose of decoration.

The metallic imitation of wood work which is used varies in design for each station. It is usually remarkable for its lightness. Lighting is accomplished from three points; vertically from above and laterally from two sides where windows are placed. The rest of the carpenter's work is covered with corrugated iron.

The immense vaulted hall at the Frederick Street station is worth mentioning; it is 230 feet wide and 492 feet long. Those at Alexander Place and at the Schlesischer station are equally remarkable.

There are as yet only a limited number of streets running alongside the viaduct; but this matter has been provided for, and they are being increased from year to year. In course of time the road will run through a wide avenue built up on either side. The vaults of the viaduct are rented at a price that compares well with the rental of the finest locations in Berlin. They are especially desirable for wine-cellars and restaurants, which are fitted up with the greatest luxury.

MOVEMENT OF PASSENGERS AND FREIGHT.

The city of Berlin, which is in the full vigor of its growth, and whose population is every day increasing, contained at the last census, 1,230,000 inhabitants.

It is difficult to determine the number of passengers which are carried over the Metropolitan Railway in the trains of the trunk lines. Their numbers can only be found in the general statistics of the different lines.

For the local traffic the average circulation is from 25,000 to 30,000 passengers per day, about 10,000,000 per year.

The price of third-class tickets from one station to another is 2.4 cents, and for a through ticket 9.6 cents. In second class the corresponding charges are 2.4 cents more. Commutation tickets are sold to workmen at a reduced price, but they are only good from seven o'clock in the morning to six o'clock in the evening in winter, and from six o'clock in the morning to seven o'clock in the evening in summer.

Freight trains are not run over the tracks of the Metropolitan Railway, but are sent over the Belt line.

A sense of admiration will be felt when the Berlin Metropolitan Railway is carefully studied.

We may criticise on many of the features and dispute the art stic value of the several parts, but it is none the less true that the whole is exceedingly remarkable, as well for the conception of the work, as for the great care taken in the execution of the smallest details. Furthermore, aside from its strategic importance, the Metropolitan has become in a few years indispensable to the Berlinese population. It has enriched certain parts of the city, here-tofore poor and neglected, and, thanks to it, entire quarters have been built upon portions that were formerly worthless. In subsequent issues we propose to give further descriptions of the structure and numerous illustrations of interesting features and details.

(To be continued.)

PAVEMENTS AND STREET RAILROADS. No. XXVII.

(Continued from page 116.)

ASPHALT AND OTHER PAVEMENTS IN THE CITY OF LONDON.

CONTINUING our account of experience in England, we come next to a series of reports on the pavements in the "city of London" proper, where the travel is probably more per unit of width than in any other city in the world. We are indebted for the information to William Haywood, Esq., Engineer and Surveyor to the Commissioners of Sewers of the city, and the reports date from 1886 back to 1853. The first wood pavement seems to have been laid there in 1839. One laid in 1842 up to 1853 had had two renewals, making the average total cost (including 4½d. per annum for repairs) to be 1s. 11d. per year. Granite for the same time cost 9¾d. total per year. To the cost above for wood should be added about 1½d. for sanding to prevent slipperiness. The duration of granite in this statement is taken at 25 years.

The practice is to lay the new granite in the streets carrying the heaviest traffic, then after a certain amount of wear to remove it, redress it as required, and lay in second-class streets, and, finally, after a second removal, it is

placed in streets with least traffic on them. The dressings are used in macadam, and finally the worn-out stones take the same course.

Statistics are given of a granite pavement on London bridge where it lasted 12 years under this enormous traffic before renewal. The stones, originally 9 inches deep and 6 wide, had worn down an average of 2 inches. The cost per year was 4½/d. for maintenance and 1s. 10¾/d. for laying, or 2s, 3d. per year.

In the Poultney, another very busy street, the wear in six years was 1 1/2 inches.

From a table given we learn that the first squared granite blocks were laid down in 1828 and were not renewed for from 16 to 25 years. These were 6 inches square by 9 inches deep. The 3 and 4 inch granite cubes were introduced in 1844, and bore the very heavy traffic of Cheapside and similar streets for 7 to 9 years before relaying, many of the blocks being still fit for use.

Up to 1852, of 21 wood pavements, the time down before renewal ran from 23 months up to 8½ years, the larger number lasting less than 4 years.

There are about 51 miles of public ways in the "city," containing 441.250 square yards of carriageway and over 300,000 square yards footway.

The next report in the series dates 1870, and contains an account of a pavement called "McDonnell's patent Adamantean," composed of broken stone not over 3 inches diameter imbedded in asphalt, and laid in blocks 18x12 inches and 6 inches deep, with **X-inch joints filled with asphalt.

An interesting case is reported where suit was brought by the owner of a building against the commissioners for damages caused by raising the grade of the street so that he had to use steps to go down to his property. The case was decided on final appeal in favor of the commissioners, on the ground that it was done in the interest of public traffic.

The report states that since 1867 the commission has removed all dust, ashes, and trade refuse.

The street "orderly" system and erection of iron bins along the sidewalks for the reception of the manure collected was begun at that time and has been continued to the present.

The average amount of material removed per week, not including snow, was 972 ½ loads.

The usual requirements as to maintenance are as follows: In the case of asphalt pavements the contractors for the pavement when new agree to maintain it in good repair for two years without cost to the city, and after this for fifteen years more at a price per square yard per annum named at the time of bidding and based on the total area paved. The pavement to be in good condition (to the satisfaction of the engineer) at the end of seventeen years, and to weigh at that time not less than a given amount per square vard.

For wood pavements the agreement is entirely similar except the provision as to weight.

The report of 1871 mentions the first laying of granite blocks with wide joints, and filling with small pebbles, and a composition of pitch and creosote oil poured hot.

Observations made that year show that there were fewer falls of horses from slipping on pavements of compressed asphalt than on the ordinary granite pavement.

Experiments were made that year on melting snow from the streets by steam and gas.

On account of disturbance of the streets for laying pipes of various kinds subways are pointed out as the only remedy. They were then in use in four streets.

It is interesting to notice in all the reports thus far frequent mention of street widenings, which have done so much towards relieving the street traffic during recent years.

In 1872 mention is made of the failure of a pavement consisting of blocks of compressed asphalt laid on concrete and grouted with bitumen. These were 12x6½ inches and 2½ inches deep. Much consideration was given to asphalt pavements this year.

The first specimen of the regular Nicholson wood pavement was laid also, and as asphalt was considered unsuitable for grades steeper than one in sixty, wood is suggested as a possible substitute in such localities, taking the place of the asphalt.

Complaint is still made of the disturbance of the streets for laying of pipes.

In 1873 the Adamantean pavement laid three years before is reported upon. It showed serious wear at the

end of one year, at the end of eighteen months received extensive repairs, and in two years was so bad that further payments upon it were withheld,

A pavement of Trinidad bitumen, broken stone, chalk etc., laid hot, was proven to be a failure; also, one consisting of a mixture of certain oils, caustic lime, pitch, sawdust, etc.

A pavement of compressed asphalt from Seyscel rock (Societé Française des Asphalte), also from Montrotier asphalt, proved enduring.

Experiments also showed that such pavements would not aid in spreading fire.

Patent wood pavements of various kinds began to be experimented with.

A footway of Portland cement laid under pressure was also put down.

Seven street-sweeping machines are reported in use.

The washing down of streets paved with asphalt begun in 1866, and was still under trial as an experiment.

It would seem from a statement made here that the city retains full control of the subways under the streets.

• More streets were torn up for pipes of the Gas Company and Hydraulic Pressure Company.

Conflicts of authority are noted between the Commission and Metropolitan Board of Works as to control of certain streets, etc.

(To be continued.)

THE NICARAGUA CANAL SURVEY.

PRESS dispatches up to January 4 indicate that the surveying parties are well established in their various camps, with a comfortable headquarters at Camp Carazo, on San Francisco Island, some forty miles up the San Juan River, and probably by this time the survey is well under way; in fact, parties had been then at work some three weeks.

The boundary question between Nicaragua and Costa Rica is still unsettled, but as both countries are friendly to the enterprise it would not appear likely to make much difference to the canal whichever way it is decided, except that, of course, it would be more satisfactory to have but one country to deal with in the event of any complications.

The surveyors are hardly enjoying what might be called a "picnic." Since the parties have been at work the rain has poured down nearly every day. The fall of water has been very heavy. On December 29, in 24 hours, 6½ inches and on the day following 4 inches of rain fell. This heavy fall has caused quite a rise in the streams, which is favorable, however, to the transportation of stores to the surveying parties.

The difficulties encountered by the engineers in running their lines are very great. Much of the work is in swampy ground, which the engineers often have to go through up to their waists in water, and where the undergrowth is so thick that every foot of the way has to be cut, and it is impossible to see ahead for a distance of over ten feet. They often have to be absent from permanent camp for several days and sleep on a bed of leaves, on which they spread their rubber blankets, and only rarely when time permits can they even make a shelter of leaves. The insects are a great annoyance. Not only mosquitoes swarm about, but a countless variety of bugs of every size, color, and shape, their sting causing an itching which is almost unbearable. When absent from camp for several days engineers and men, unable to sleep under their mosquito netting, have their faces, hands, and often their bodies covered with welts, and not unfrequently the irritation causes sores.

To offset this, however, there has been very little sickness, which is confined almost exclusively to the laborers. Two of the officers have had slight fever, lasting in each case but a day or two. It seems odd that in both these instances one was a native Nicaraguan, and the other had lived a number of years in South America, while not one of those who are making their first visit to the tropics has been unwell.

In painful contrast to this the Liberian laborers imported by the Panama Canal Company, selected as exceptionally healthy and accustomed to a hot, moist climate, are reported to be dying at an annual rate of 539 per

THE first number of the London Engineer for this year gives a very careful and comprehensive survey of all important engineering works and projects throughout the world, from which in this and one or two subsequent issues we shall take several brief items and abstracts.



REPORT ON BRIDGES INTERFERING WITH NAVIGATION.

THE Secretary of War has transmitted to Congress a letter from the Chief Engineer, together with reports of the officers of the Engineer Corps in charge of various river and harbor districts, concerning bridges, causeways, and structures of any kind now erected or in process of erection that do or will interfere with free and safe navigation, in accordance with the provisions of the River and Harbor Act of August 5, 1886, of which we abstract the principal data in the accompanying table.

Besides the above, mention is made of a number of other bridges causing immaterial obstructions or that may do so under future changed conditions.

Lieutenant Colonel W. E. Merrill refers to a number of bridges over the Ohio and Allegheny Rivers previously reported on, and indefinitely to others over the Muskingum, some of which are obstructions, but recommends in all cases no action until specific requirements have been provided by Congress.

Various instances are noted of obstructing dikes, piles, foundations, and required dredging, snagging, etc., but all the definite statements of existing bridges are given below.

THE NEW STEEL CAST GUN.

The steel casting for the new 6-inch gun was lifted out of its mold five days after pouring, and, as far as surface examination could show, seemed to be an entire success. The gun will be bored—a four weeks' job—at Pittsburg, where it was cast, and then sent to Washington to be rifled. It marks a radically new departure in the manufacture of steel ordnance, and its final test at Annapolis will be watched with much interest.

ANNUAL REPORT OF THE TAUNTON WATER-WORKS.

THE twelfth annual report of the Water Commissioners of the city of Taunton, Mass., for the year ending November 30, 1887, written, presumably, by William R. Billings, Superintendent of the Works, has been carefully prepared and contains several matters of interest.

Taunton had a population in 1885 of 23,674, of which about 21,400 could be supplied by present pipes, and about 19,000 were so supplied. The total number of gallons supplied during the year was 264,618,762, of which over 11,000,000 gallons were metered as follows: 32,446,357 gallons to domestic consumers and 68,672,071 gallons to manufacturers. The average daily supply was 724,982 gallons, being 31 gallons to each inhabitant, or 38 gallons to each consumer, and about 252 gallons to each of 2,875 tape in actual use, and it may be added here that of that number there are but four unpaid and overdue bills. Water is supplied at a pressure of about fifty pounds through 55 miles of cast-iron mains from 4 to 20 inches in diameter, with 347 stop-gates and 24 blow-offs and 470 hydrants. Repairs and maintenance averaged \$50 per mile. There are 28 miles of cement-lined wrought-iron servicepipe, from 1/4 to 11/2 inches in diameter.

There are 776 meters in use, of which 718 are for domestic consumers and 58 for manufacturers, 96 having been added during the year, and this increase in the number of meters has been accompanied by an unusual increase in the receipts from water rates, more than half of which has been from domestic meters. The consumption of water is somewhat less than in 1886, which is attributed to increased rainfall during the summer of 1887, diminishing the amount of lawn sprinkling and general hose use.

We should be inclined to think that the increased use of

meters might have had something to do with it, though nothing is said on that point.

The water-works were built in 1876 by the city, and have cost to date a little over \$500,000. The supply is from ground-water, with the Taunton River for emergencies, distributed by direct pumping against an average dynamic head of 151 feet. The number of gallons pumped per pound of coal is 343, and the duty per 100 pounds of fuel is 43,316,668 foot pounds. The actual pumping expenses were \$5,281.07, being \$19.95 per million gallons against average head, or 13.1 cents per foot of head. The total cost of water delivered, figured on total cost of maintenance, was \$40,186.86, or \$151.87 per million gallons.

Some experiments were made with driven wells, but without satisfactory results, as sufficient water was not found at economical depths.

It appears from the report that the Massachusetts State Board of Health have recently arranged to make monthly analyses of samples of water that may be sent them, and Mr. Billings says: "Already the practical value of this thorough and systematic examination of all public watersupplies in the State is recognized."

OUR PACIFIC COAST LINE.

THE Pacific Ocean boundary of the United States has a greater extent of coast line than the Atlantic shore. The aggregate of our shore line on the Pacific is 12,734 miles, while on the Atlantic it is 11,860 miles, and on the Gulf of Mexico 6,843. It was the annexation of Alaska that promoted the Pacific coast to a higher figure than the Atlantic, Alaska having 9,830 miles of coast line. If the lake boundary is added it gives us a total coast line not very far short of twice the circumference of the earth.

TABULATED ABSTRACT OF U. S. ENGINEER OFFICERS' REPORT OF BRIDGES OBSTRUCTING NAVIGATION.

OFFICERS REPORTING.	DESCRIPTION OF BRIDGE.	STREAM CROSSED.	LOCATION.	NATURE OF OBSTRUCTION.	RECOMMENDED IMPROVEMENT.
MAJOR JARRD A. SMITH, head- quarters at Portland, Me.	Draw-bridge Railroad and highway draw Grand Trunk R.R. Draw, 40-foot opening Tukey's Bridge, Highway	Kennebeck River, PiscataquaR'er, between Back Cove Channel	near Gardner, Me Portsmouth, N.H. \and Kittery, Me. \Portland Harbor, Me	No guide piles and forms a shoal. Inconvenient, narrow opening. Narrow opening. Narrow opening and lacks guard piers.	
Major W. R. Livermore, headquarters at Newport, R. I.	R. R. Draw-Bridge, 45° skew, total length 185 feet. Piers oblique to axis and to current, opening on axis, 73 feet	Taunton River	bet. Somerset and Fall River, Mass.	Slow operation. Draw protection at a skew of 34°.	Increase draw opening. Make profection parallel to current.
W.LLIAM F. SMITH, U. S. Agent, headquarters, Wilmington, Del.	Two Skew Draw-Bridges of P. W. & B. R. R., piers each 36 feet 6 nches diameter, with two equal openings, 78 and 100 feet respectively	Christiania River	Wilmington, Del	Location and skew, and narrow opening.	
Major-Gen. O. A. Gillmore, headquarters, New York City.	Draw-Bridge with two 75-foot openings near side of channel Toby's Bluff Bridge Charleston and Savannah R. R. Bridge, 38-'oot opening. { Port Royal and Augusta R. R. Bridge, 90-foot draw opening, 75' skew Savannah and Tybee R. R. Draw-Bridge Ferdinand and Jacksonville R. R. Draw-Bridge. { County Bridge, Draw-Bridge. {	JAVAGUAN KIVEI	1		Guard piles.
CAPTAIN W. M. BLACK, headquarters, Jacksonville, Fla.	Florida Southern R. R. Draw-Bridge	Ocklawaha River Withlacoochie River Pease River	nr Lake Dora, Fla. Pemberton Ferry, Fl) bet. Owens and) Fort Ogden, Fla.	Praw settled, immovable and abandoned. No draw span.	No present commerce there.
Major A. N. Damrell, headquarters, Mobile, Ata.	Alabama and Great Southern R. R. Draw-Bridge Mobile and Birmingham R. R. Bridge Louisvi'le and Nashville R. R. Bridge Vicksburg and Meridian R. R. Bridge County Highway Bridge County Highway Bridge, 28-foot draw opening.	Combigbee River W.Pascagoula R'er.	Jackson, Ala Jackson, Miss	Location of structure. No draw span. Draw opening too narrow	Move it 900 feet down stream.
CAPTAIN C. B. SEARS, headquarters, Bismarck, Dak.	N. P. R. R. Bridge	Big Horn River	Montana	Low bridge without draw	100-foot draw opening.
CAPTAIN E. H. RUFFNER, headquarters, Quincy, Ill.	Hannibal Bridge	Miss. River			
Colonel Wm. E. Merrill, headquarters, Cincinnati, O.	Monongahela City Highway Bridge, 216-foot channel span	Mocongahela River. Little Kanawha { River	Parkersburg, Pa	42 feet high above high water	water.
BRIGGRN. O. M. Por, headquarters, Detroit, Mich.	Highway Draw-Bridge on piles	Rouge River	Monroe Road, Mich.	Narrow draw opening	Obstruction practi- cally removed on ac- count of bridge having failen down.
CAPTAIN C. F. PALFREY, headquarters, Oswego, N. Y.	D. L. & W. R. R. Pier and Coal Trestle	Lake Ontario	Oswego, N. Y	Insufficient clearance.	
Major W. A. Jones.	Iron Bridge on tubular piers, one 161-foot span and three 262-foot spans, and one draw span, with 154 and 136 foot openings, on stone piers	Williamette River	Portland, Ore	Located in dangerous currents and divides the harbor. Digitized by	Coogle



PLUMBING IN THE RESIDENCE OF MAX NATHAN, ESQ.

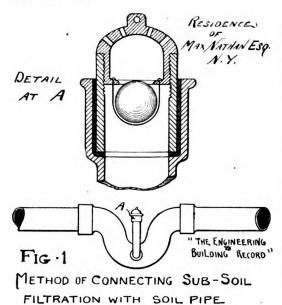
THE following is a description of the details of the plumbing and drainage system in the residence of Mr. Max Nathan, 22 East Seventy-second Street.

The building is four stories, with extension the same height; cellar under the entire structure. The steam-heating plant is provided in the cellar, heat being admitted through registers under the windows in the different rooms. The floor of the entire cellar is laid with concrete.

DRAINAGE SYSTEM.

The soil-pipes are extra heavy cast iron, and the main is six inches in diameter from the sewer through hall to extension, where it is reduced to five inches and carried to rear of extension, there crossing to opposite side, thence returning to wall of main building, where it terminates. The object of extending this pipe on two sides of the cellar in extension is to facilitate connections with the leaders and surface drains of the yard located parallel with it.

About seventeen feet from rear wall of main building a 5-inch soil-pipe branches from the main and is carried up a recess in this wall to the roof. All waste-pipes in the bath-rooms are connected with this soil-pipe. Another 5-inch soil-pipe branches from main in the extension and also carried to roof.



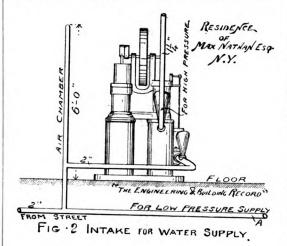
A vent-pipe, three inches in diameter, branches from soil-pipe in extension and is carried to roof, terminating near the 5-inch soil-pipe. The main horizontal soil-pipe can be examined easily at any time by means of handholes, which are provided every fifteen feet in the entire length of the pipe located inside the cellar; therefore, if any obstructions occur they can be quickly removed. A section of these handholes is given on page 105 of Volume XVII of THE ENGINEERING AND BUILDING RECORD. The trap on main soil-pipe is inclosed in a basin which is located in a vault under front steps about twelve feet below sidewalk, and on account of this depth will be liable to become filled with water from the subsoil; but to remove any water that may enter, the device shown in Fig. 1 has been adopted. This device consists of a pipe, two inches in diameter, joined to a hub on the side of trap at the lowest part of bend, thence extending vertically up to flowline of soil-pipe. The top of this 2-inch branch terminates in a brass cap, which is convex and perforated with holes, through which all surface water in this basin above flowline of soil-pipe will enter and be removed.

A circular brass sleeve is leaded into hub of the vertical 2-inch pipe, and a cap secured to this sleeve by means of a screw-joint. This device is sealed against any back flow from soil-pipe by means of the rubber ball shown under cap, which will rise and close the orifice whenever the pressure in soil-pipe is too great. The wire inclosing this ball extends two inches below orifice in cap. The arrangement of ball and opening is shown in Fig. 1.

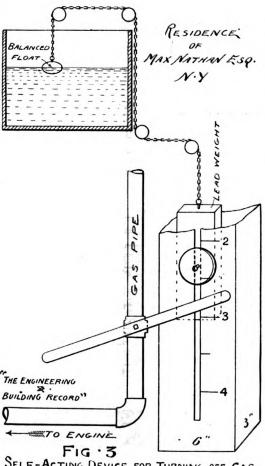
WATER-SUPPLY.

The material used for all pipes in the water-supply system is galvanized iron, except wherever the pipes are exposed in the bath-rooms, then nickel-plated brass pipes are used; but all galvanized-iron pipes where exposed through the building above the cellar are covered with silver bronze.

The main pipe from street to intake, shown in Fig. 2, is two inches in diameter. The water-supply system consists of a street and tank supply, or low and high pressure. Figure 2 represents the intake which supplies water for low-pressure system, with a hot-air engine utilized for pumping water up to a tank located on roof of extension. The top of this tank is 80 feet above the cellar floor. The illustration shows a vertical pipe two inches in diameter that is connected at lower end with main, thence extending to ceiling of cellar, forming an air-chamber six feet or less in height. A pipe of the same size branches from it



and joins lower part of engine, and on this horizontal pipe is set a conical air-chamber. A vertical pipe 1½ inches in diameter, also provided with a conical air-chamber, is carried up through the elevator shaft to tanks shown at N in Fig. 4, through which the high-pressure supply is forced into the tank. The intake, therefore, is provided with



SELF-ACTING DEVICE FOR TURNING OFF GAS FROM ENGINE WHEN TANK IS FILLED.

three air-chambers to modify the pulsations of the pump. The tank is located on the roof of extension, inclosed with brick walls, but is accessible from roof of main building. The tank is made of boiler-iron, the dimensions being 8 feet by 5 feet 6 inches and 4 feet in height, contain-

ing 1,200 gallons. The overflow-pipe from this tank is 3 inches in diameter, extending to roof of main building, where it discharges, as the top of tank extends above roof. No tell-tale pipe is provided for the tank for reasons that will now be explained.

An automatic device for controlling tank supply is illustrated in Fig. 3. It consists of a long vertical box of wood, about six feet in height, secured to a partition inclosing the intake. Within this box a lead weight 8x3x2 inches is held suspended by means of a brass wire chain, which extends up over pulleys, as shown, to tank, where a float is secured to opposite end resting on the water in this tank. The lead weight and float are sufficient to overcome all friction produced by the chain in passing over the large number of pulleys required between the cellar and tank. A wheel about one inch in diameter is secured to counterbalance weight and bearing on the lever attached to gascock, thereby imparting a more uniform motion to the lever as the weight descends. This lever is secured to a stopcock set in the gas-pipe near the counterbalance. It is provided with a vertical slot instead of a round opening, and, therefore, will require only a slight depression of the lever to turn off the gas-supply to engine. The numbers on the face of indicator extend down from top, consequently the wheel will indicate the depth of water in tank at all times,

The operation of this device is as follows: The gasburner is lighted, which soon sets the pump in motion, filling the tank. The float in tank rises with the water and causes a corresponding depression to the weight in indicator, and when tank is filled the wheel by depressing the lever turns off the gas, stopping the action of pump. This lever must be raised by hand before the gas can be lighted; there is, therefore, no danger of the gas being turned on accidentally. After the gas has been lighted no attention is required until the indicator shows that the tank requires refilling.

A sink is located near the intake which receives the discharge from safe wastes. A sink is also located in the extension for butler's use.

A large grease-trap is set under the kitchen, and in the centre of this trap waste-pipes from the butler's pantry and kitchen sinks discharge, flowing thence through into the soil-pipe.

(To be continued.)

THE COMPARATIVE MERITS OF THE ONE AND TWO PIPE SYSTEMS OF STEAMHEATING.

BROOKLYN, December 29, 1887.

SIR: I notice in your issue of the 24th inst. an inquiry from a correspondent in reference to the one-pipe system of steam-heating and your reply thereto, and would like to say a word in reference to the matter. You say, first, that the system is often at a disadvantage in buildings that cover a good deal of ground, when contrasted with the two-pipe system. This is not the case with the one-pipe system, as that term is now used—that is to say, where but one pipe is used for feed and for return for vertical pipes and radiator connections, and separate systems of horizontal feed and return pipes are used. The writer has seen a number of dwellings and similar buildings in which there was not a return or relief pipe of any description, the water of condensation being all returned through the steam-mains, and of course discharged into the top of the boiler. These were all old jobs, and the boilers had to be set very low in order to get the required inclination for the pipes. In regard to a radiator with but one pipe making more noise when steam is turned on than if it had two pipes, I must say that it is news to me, though I have seen steam turned on to a good many radiators with both styles of piping. That it takes longer to free the radiator from water with one pipe than with two I admit, but your remarks in regard to the results caused by a leaky valve, or one not properly closed, will apply equally well to both styles of piping, with this decided advantage, however, on the side of the one-pipe system, that there are only half as many valves to get out of order or be carelessly operated; for with the two-pipe system, as with the other, everything wants to be shut tight or else be wide open, though it is hard to make some people (and not a few either) believe that they haven't done their whole duty when they have shut the feed-valve and left the return-valve to take care of itself. Finally, I claim that in low-pressure heating, where the one-pipe system is admissible at all, it has some decided advantages which do



[There is very much less objection to a one-pipe system that has separate steam and return mains than there is to a one-pipe system with no separate return main. It is, in fact, a two pipe system as far as the mains are concerned. The principal objection, however, to a radiator with a single pipe and valve for both the steam and the condensed water is, that when the radiator is full or partly full of condensed water there is a conflict between the steam to enter and the condensed water to run out. When steam is let into an empty radiator, as the specific heat of the iron is not great, and as it takes some time to expel the air, the influx of the steam as well as the condensation is comparatively slow, and thus the condensed water is enabled to run out along the bottom of the steam-pipe in a contrary direction to the flow of steam without difficulty. provided the pipe is large enough. If, however the radiator has been condensed full of water by being imperfectly closed the steam cannot flow in until the water flows out.

During this struggle for right of way portions of the steam are suddenly condensed and the vacuum thus formed sucks violently back the escaping water with the effect of causing that sharp, uncushioned blow called a water-hammer, so well understood by the experienced engineer and so disagreeably familiar to all users of defective steam-heating arrangements.

This water-hammer will occur also in the two-pipe system under like circumstances, but as in that case the steam is driving the water out before it there is no struggle for right of way, and as the steam and water are less mingled the water-hammer is not likely to be so severe and is certain to last for a much shorter time.

This is the principal objection to the one-pipe system and exists no matter how large the steam-pipe or how well and carefully run, no matter what the pressure used, which is usually low—about one pound.

A two-pipe system, however, can be so arranged that it will will not make a "water-hammer," no matter how badly it is managed by the user, if it is run at very low-pressure, and only one valve will be required to operate each radiator. When the return-pipe of each radiator of a very low-pressure system is carried separately below the water-line, the return-valve can be omitted on the radiator, or, if put on, it can be allowed to remain open; then the radiator can be operated with all the ease and convenience of the one pipe system, and as the radiator can never get full of water, the noisy disturbance above described cannot occur.

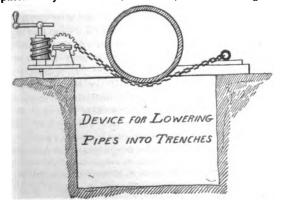
This is plain to any one thoroughly versed in low-pressure heating, but for the information of our less experienced readers we will explain that when steam is shut off from a radiator whose return-pipe runs separately to below the water line unless the pressure carried exceeds one pound for every 28 inches that the radiator is above the water-line, the water will not back up into the radiator, and there will consequently never be any water in it, provided, of course, that the usual automatic air-valves are used, which prevent the formation of a vacuum that might otherwise suck the radiator full of water when the steam was shut off.]

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

DEVICE FOR LOWERING OR RAISING PIPES IN TRENCHES.

THE accompanying sketch shows a novel device just patented by Lewis Boore, of Buffalo, N. Y., and assigned



to Theodore H. Meyer and others, of the same place. It consists of a portable frame adapted to rest over the trench, provided with two separate and independent chains, one end of each being removably attached to one side of the frame and the other end of each being secured to and adapted to be wound upon separate drums, each being adapted to be operated independently by separate gearing and lever-handles.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

VALVE WANTED TO DRAIN CELLAR AND KEEP BACK-WATER OUT.

SIR: Kindly inform me where I can get a good valve to drain cellars and to keep the back-water out, as I have a customer who wants something of this kind.

Yours respectfully, Louis Waefelaer.
54 Beekman Street, New York.

[There are back-water traps advertised in our advertising columns. We do not know of a valve for the purposes mentioned. May be some of our readers can supply the information.]

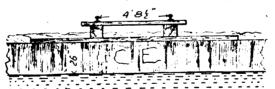
RAILROAD TRAINS CROSSING THE ICE.

A CORRESPONDENT recently wrote us the following:

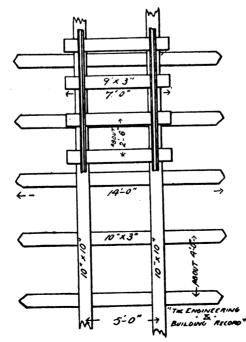
"In previous years I have frequently heard, at about this season, of railroad crossings over the St. Lawrence being effected by simply laying ties and stringers directly on the ice, spiking the rails to the longitudinals and runing the locomotives and trains over this track as on dry land. As the subject is of considerable novelty and interest to myself and probably others, can you publish the details of this matter, the size, dimensions, and arrangement of ties and stringers; if they are in any way fastened down to the ice; if curves are permitted and of what degree; if any ballast is used between ties? What is deemed the minimum safe thickness of ice, if any restrictions of weight, length or speed of trains are imposed, and what are the heaviest engines permitted to cross? For any, or all of this, or other pertinent information on the matter, I should be greatly obliged to your valuable paper. Respectfully yours,

[We referred the above inquiry to Mr. P. A. Peterson, Engineer of the Canadian Pacific Railway, and are indebted to him for the following data and the sketch from which the accompanying illustration has been made.

This sketch shows the railway as it was put down the second and third years. The first year the



ICE BRIDGE RAILWAY -- ST. LAWRENCE RIV.



longitudinals were laid directly on the ice, but afterwards they were laid on cross-timbers about 14 feet long, 3x10 inches, and spaced 3 feet centres. Ordinary 16x24-inch locomotives were run across this track drawing trains of loaded cars. It was found that in some places the ice cracked, and lighter engines were then used. The sketch will show the size, dimension, and arrangement of stringers.

It should be understood that the ice at this part of the river is principally packed ice and not frozen in a solid sheet. It is formed of bordage ice and frazil, which comes from the rapids above and jams at this point and is then frozen together. There are parts of it where there is simply the ordinary ice of the river. The ice was leveled off, cross-timbers laid down, and holes were then cut at the side of the track, from which water was taken and thrown over the snow and level ice, so that the timber, ice, and snow were all frozen together. The ice was found strong enough when the lower cross-timbers were put under the longitudinals to carry a 16x24-inch passenger engine built at that time.

LONDON CORRESPONDENCE.

In presenting the certificates at the conclusion of the winter term to the students of the Crystal Palace School of Engineering, Mr. William Henry Precce, F. R. S., Mem. Counc. Inst. C. E., bore testimony to the advantages possessed by an applicant for engagement in an engineer's office, if he held the certificates of the school. As a member of the Council of the Institute of Civil Engineers, he stated that the possession of the certificates was a passport for any one desiring to enter the institute as a student. In the course of his remarks on the value of such training for young engineers, Mr. Preece referred in eulogistic terms to the Boston Engineering College, pointing out that that establishment was the result of private munificence. He claimed credit for the engineering profession for the position held by England as a nation, on the ground that electricity and steam have placed England in communication with the rest of the world, a fact very frequently forgotten by politicians, who claimed the credit. Referring to the point of admittance to the Institute of Civil Engineers, Mr. Wilson, M. I. M. E., M. I. C. E., the principal of the school, stated that the regulation had just been made, that only those applicants possessing the certificates for the two years' course would in future be able to look for admittance as students on the strength of those credentials. It is a matter of great regret, that the Crystal Palace authorities, who derive a larger proportionate income from the school, than from any other part of the establishment, educational or otherwise, are so shortsighted as to "staive" the workshops with lack of good machinery. The bad machinery with which the students had to work was a matter of comment on the part of one of the examiners.

In Madrid, Spain, the authorities have decreed that all theatres must be lighted by electric lights. It is stated that the authorities have decreed that all theatres not lighted by this medium will, perforce, be closed.

The scheme to bridge the English Channel from Boulogne to Folkstone is arousing very much the same "flutter" in the breasts of a great number of people over here as was the case in the Channel Tunnel scheme. Newspaper articles, written in the most serious spirit, decline to submit the safety of England to the care of a sleepy watchman or sentry. There is evident fear that the bellicose and acquisitive spirit of our French neighbors is such that they would unceasingly watch for the first surreptitious "nap" on the part of the sentry and immediately, in that event, march a large army over. The presence of any engineering skill capable of destroying the bridge (or channel) in the case of war is discounted.

MAJOR MARINDIN, acting as Inspector for the Board of Trade, in his report on a recent railway accident on the North-Eastern Railway, gives point and force to a complaint which has long been made by the railway employees all over the country. He attributes the accident in great measure to the long hours the men have to work. The engine-driver had been at work 31 hours, and the other men even longer. He states that such hours of work should not be tolerated either in justice to the men themselves or in the interest of the public; it being impossible for a driver, however good a man, to work for such a time without getting worn out, and being consequently inattentive and unfit for the performance of such responsibilities.



Gas and Electricity.

Illuminating	Powe	r of	Gas in	New	Yor	k City	
Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutua. Gas-Light Company	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
January 28	23.51	19.40	20.48	31.11	28 27	22 38	3 ¹ 37

SPACING TRAVELER FOR MULTIPLE PUNCH.

THE accompanying figure illustrates a device designed and used by the Smith Bridge Co., of Toledo, O. It is made from a pencil sketch, showing the essential features of worm-gear and hand-wheel.

The punch-table was a long bed, carrying at frequent intervals the rollers, R, with track-rails, on which an ordinary four-wheeled truck is mounted. One axle of this truck carries a pinion engaging a rack parallel to the rails. At the centre of the same axle is a wheel geared into the worm of a vertical shaft, which has an upper bearing in circular plate P; a horizontal wheel, W, is keyed to the end of shaft above and just clearing P. One revolution of this wheel propels the truck exactly one inch on its track. The handle of the wheel is bored to admit a plunger rod, A, with button-head. B, which is held up by a spiral spring in the chambered handle. The plate P has eight equidistant holes in a circle just under the centre of handle and bored to fit the plunger. C is any convenient grip.

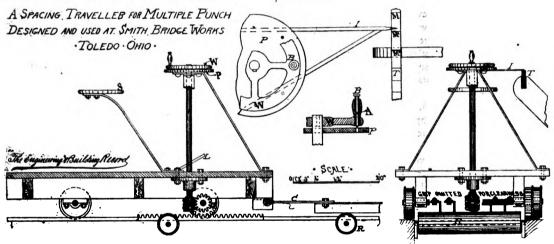
satisfactory results. Early in the spring of 1887 the owners of the Riverside Iron-Works, of Wheeling, W.Va., decided to build and operate a tube-works for the purpose of utilizing, in the manufacture of iron pipe, the product of their rolling mill and forge plant, which had then laid idle for about three years, by reason of the substitution of steel for iron in the manufacture of nails.

During the progress of the construction of the tubeworks the general manager of the company, Mr. Frank J. Hearne, discussed with the writer the possibilities of steel as a material for pipe making, and it was then decided to put the matter to a practical demonstration.

Towards the latter part of August about thirty tons of steel were made and rolled into skelp and delivered at the tube-works as a trial lot, to be made into pipe.

The welders at the furnaces said at the outset that it would not do, that it would not stand fire, and, by reason of their prejudices against steel, they subjected it to abuse by severe overheating; yet every piece of that lot made a sound salable pipe, the welders remarking that "it was the best material to weld they had ever handled." It was threaded and finished with the same success as it was welded.

Soon after this several lots of one hundred tons each were made, and a record kept of the loss in the furnaces, crop ends, leakers, etc., which proved to be so very favorable to the use of steel for pipe-making that the company decided to manufacture steel pipe exclusively, and to abandon the use of their forge and iron-making plant altogether.



In operation a template T is prepared, having the rivet pitch indicated by transverse pencil marks M, and placed in convenient wall-brackets. The end hole is laid off and punched in the required piece or set of pieces, and while the punch remains in the hole, the truck (the worm-gear being disengaged) is run to the end of the piece and grips C rigidly attached. The attendant mounts to seat S, engages worm-gear by foot-lever L and adjusts template T, so that the first mark M' is exactly coincident with point of index I.

The punch is then withdrawn from hole and attendant rapidly turns W until I approaches very near M', whenhe depresses B with his thumb and A engages the first hole met in P, the truck stops, the required hole is punched, B is released, and the operation rapidly repeated.

The pitch is, of course, in eighths of an inch or multiples thereof, and is punched with great exactness. When the sketch was made the machine was punching six holes through as many long $2\frac{1}{2}x2\frac{1}{2}$ L's, guided at die-block by spacing fillers, and was easily and rapidly propelled by one man, while one other worked the punch-lever. These two men were able to handle material from adjacent skids with the differential hoist and performed the work usually requiring at least four men on a spacing punch. Up to a pitch of about three inches a hole can be punched at every revolution of an ordinarily-speeded punch; for greater pitches it is safer to take alternate revolutions.

THE MANUFACTURE OF WELDED STEEL TUBING.*

FOR a number of years past experiments have been made with steel as a material for the manufacture of welded pipe and boiler tubes, but with varying and un-

*Abstract of a Paper read before the Engineers' Society of Western Pennsylvania January 17, 1888, by Thomas J. Bray, Superintendent Tube Department Riverside Iron-Works, Wheeling, W. Va. The steel used is made in a Bessemer converter, the chemical analysis I am unable to give correctly at present, but, regarding its physical properties, can unhesitatingly say that it is the smoothest, toughest, and kindest material to work with and to weld into pipe that has ever been tried or used by the writer.

Samples cut from ordinary Riverside steel pipe show the character of the material in the cold and hot states. A washer was made out of a piece of four-inch steel pipe one and one-half inch long by a blacksmith, by turning one edge of the pipe inwards and flanging out the other edge, then flattening it out into a washer. Two goblets were made out of two inch and four-inch pipe respectively, necked down and welded to form a leg or stem, then flanged out for foot and mouth.

There is considerable loss in iron butt-weld pipe by its splitting in the weld on being tested to the regulation pressure of three hundred pounds per square inch. With steel pipe this loss is reduced to less than one per cent, by reason of the superior welding qualities of this steel over iron.

This steel is made at the Riverside Steel-Works by Mr. E. L. Wiles, M. E.

The paper was discussed as follows in the absence of the writer:

Mr. A. E. Hunt, in showing the samples, stated that while the results were good they were no better than those obtained by many other makers of soft steel; that his experience proved steel could be welded almost as easily as iron, and suggested as his idea of the composition of such steel the following analysis: Carbon, under .15 per cent.; manganese, at least .50 per cent. and up to 1 per cent.; silicon, less than .02 per cent.; sulphur, less than .03 per cent.

Mr. P. Barnes, Superintendent Jones & Loughlin, Limited, stated that he had been advised by the manager of the Riverside Works that their analysis was: Sulphur, about .06 per cent.; manganese, about .25 per cent., with carbon and silicon about as stated by Mr. Hunt, but that he was of the opinion that more was due to the skillful manner in which the steel was handled in the work that to the chemical composition of the metal; that while it had been found that the cutting of the threads in steel pipe was harder on the dies than cutting iron pipe the increased service and consequent economy more than compensated for extra cost of tools.

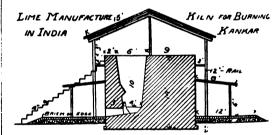
LIME MANUFACTURE IN INDIA.*

THE lime is not obtained by burning ordinary limestone, but by reducing a nodular substance called kankar, which is found in beds near the line of the work. This material may be defined as an argillaceous limestone containing from 30 to 37 per cent. of sand.

The beds generally occur some few feet below the surface of the ground, and are found by probing with iron rods. The kankar is broken to a gauge of 1½ inches and thoroughly cleaned from all dirt and small pieces before being introduced into the kiln. The reason given for breaking it to so small a size is that the nodules may be directly fed to a Sucop's pulverizer without the necessity of further breakage.

Dust coal is used for burning in the kilns, which are generally of the perpetual type. These kilns are built in continuous double or single lines or grouped four together, the single-row plan being preferable, as it allows of easier drawing.

The process of burning is as follows: The kankar is carried from the stacks to the kilns and placed therein in layers alternately with the coal. The kankar layers should be about three inches thick and rather thicker in the centre of the kiln than at the sides. On the top of each layer of kankar is spread a laver of coal (which cannot be too finely ground) about a quarter of an inch thick; the best way is to measure out the correct proportion of coal and spread it as evenly as possible over the kankar. In starting a kiln, the flues at the bottom should be closed with dry bricks and a layer of upla laid first of all. After loading the kiln as above described, one or two bricks are removed and the upla set on fire. When the fire has reached nearly to the top of the kiln, which can be known by probing with an iron rod, all the bricks should be removed, and about one quarter of the contents of the kiln withdrawn from the bottom, the kiln being filled from the top as before; after the kiln is working properly, the burnt kankar should be withdrawn every morning.



It requires considerable care in burning to prevent this burnt material from becoming vitrified when the kiln is recharged. To prevent unequal settlement the kilns were choked by the corbelling shown on the opposite side from the flues, the amount of projection being arrived at by experiment. This was partially successful, but not quite. and the lime burning required more supervision than is usually the case. This unequal settlement also affected the quantity of burnt material turned out. A 15-chamber kiln contains 3,150 cubic feet, and an out-turn of 1,200 cubic feet per diem was calculated on. As an average, l was never able to get more than 1,000 cubic feet per diem. When the kilns were first started the out-turn was about 800 to 850 cubic feet on the average, and after carefully supervising the burning I came to the conclusion that this was also due to the unequal settlement. At the beginning of this season a 30-chamber kiln was built and left unroofed and its out-turn was 2,000 cubic feet, against 800 cubic feet from roofed kilns of half the size. A native burner suggested that the roof of the small kilns was stopping the draught, and as every other reasonable suggestion had been acted on without effect, the roof was removed. In the course of a tew days the out-turn went up to 900 cubic feet, and finally to 1,000 cubic feet, where it has remained

*Summary of a report by Mr. N. F. Mackenzie, Executive Engineer, Nadrai Aqueduct Division, Lower Ganges Canal, published in the Indian Engineer.



ever since. It is therefore not advisable to roof the kilns.

After burning, the material is ground in a Sucops pulverizer to various degrees of fineness, the finest mesh (12) being about the same as that used for passing ordinary English Portland cement.

In order to get some idea of the results of grinding the lime of different degrees of fineness, various sizes of screens were used, and the following table shows the breaking weights per square inch of the different kinds of mortar. These were all treated in the same way. The lime was sent direct from the mill to the mortar-pans in the foundations, there mixed and returned to the experiment room, where it was molded into briquettes and set under damp grass, that being a nearer approach to the conditions under which the mortar sets in the work than the method of setting the briquettes under still water.

Each result is the average of six or eight tests.

Breaking weights in lbs, per square irch fo set under damp erass for various periods.										r lime	
Description of lime.	I month.	2 months	3 months.	4 months.	5 months.	6 months.	7 months.	8 months.	9 months.	to months.	ır months.
	_										 -
Season, '85-6.	66	140	159	177	no t'st	200	200	208			227
6 Mesh			• • • •			196	238			206	283
8 Ditto	٠.,		• • • •	• • •		204	244	269			287
To Ditto			• • • •	• • •		214	248	263	358		301
ra Ditto		• • • •	• • •	•••		237	276	292	312	311	no t'st

The "season 1885-86" lime is a mixture of several different gauges, the kankar, however, being the same as used for the other tests.

Owing to a scarcity of screens, various kinds were employed, and the lime was not kept separate in the godowns. The general result is inferior to that of the other tests, where the various sorts were kept quite separate.

It will be seen from the above table that in the sixth and seventh months the finer the lime the higher the breaking weight, and after those periods the results do not differ very much. I infer from this that the finer the mortar the quicker it sets, although in the ultimate tests when the morter has finally set, the breaking weights do not vary very much with lime, all of which is ground very fine, although, as a general rule, the finer the lime the better the result. This is shown plainly by the difference between the 6-mesh and the 12-mesh tests.

WADDELL'S SPECIFICATIONS FOR IRON AND STEEL HIGHWAY BRIDGES.

In this publication by J. A. L. Waddell, Mem. Am. Soc. C. E., the specifications are accompanied by a review of the highway bridge practice in the United States. The introduction is a forcible presentation of the urgent necessity for reform in the methods of securing highway bridges. Some disasters are noted that were due to incompetency, dishonesty, and criminal carelessness of contractors, and some precautionary measures are outlined.

The author describes the crooked practices and skin games of bridge fakirs and dishonest contractors (even county commissioners sometimes) at bridge lettings, and mentions some of the infinite variety of devices for evading specifications and scamping work. He notes some of the commonest heresies and mistakes in designs, and presents some excellent principles and hints for the intelligent designer. An association is proposed to be formed of bridge engineers, builders, and contractors for mutual profit, improvement of work, protection, and restraint, to be bound under penalty of heavy fines to do first-class work. These purposes are laudable, but their fulfillment as proposed is certainly impracticable.

Mr. Waddell presents minute and comprehensive specifications for design, in the main correct and desirable and as applicable as general specifications can be. "The manufacturers' standard specifications" which have been adopted for metal, are incomplete and in some points objectionable, especially for steel, being much behind the times in the present rapid development of its manufacture and uses.

The specifications for shop work embrace many good points, but cannot cover the wide field. They form a good text, however, for general guidance, and should be supplemented by special instruction to inspectors.

The subject of piers and abutments of masonry, or other material supporting iron and steel superstructures, has been omitted.

The education of the public that the author advises must be limited to the possible and useful. We believe that to secure a general realization of the importance of the subject and its present dangerous and wasteful treatment, and to direct careful, intelligent consideration to local structures, is the most that can be attained.

The "every man his own engineer" principle is mischievous and dangerous, and contractors cannot be absolutely relied on for voluntary disinterested conscientiousness much this side of the millennium.

Buildings are (rather should be) engineering structures, and as such should invaribly be designed and approved by experts, and their construction subjected to constant rigid inspection. These requirements should be legally provided for and enforced by State legislation, and we are glad that an effort is being made in Pennsylvania, and proposed in several other States, to secure the necessary laws.

Mr. Waddell's pamphlet should reach township authorities. His recital of the tricks of the unscrupulous contractors and committeemen will have a good educational effect. The specifications might be published separately, as they are necessarily too technical to be of much use to laymen.

ILLINOIS SOCIETY OF ENGINEERS AND SUR-VEYORS.

THE third annual meeting of the Illinois Society of Engineers and Surveyors was held in Springfield, O., on the 25th, 26th, and 27th of January.

Morning, afternoon, and evening sessions were held and the attendance throughout was large. The reports of the several officers and committees were submitted and acted upon, and numerous interesting papers were read by different members of the society.

Senator Cullom's bill establishing a Bureau of Public Works was approved.

On Thursday, January 26, the society went on special train on Wabash Railway, by invitation of Charles Hansel, Chief Engineer, to the rolling mills and other points of interest.

A feature of the meeting was the exhibition of drawings, which was large, varied, and interesting. Thirty new members were elected, and the following officers were chosen for the year 1588:

President, C. G. Elliott, Gilman, Ill.; Vice-President, D. W. Mead, Rockford, Ill.; Executive Secretary, Professor A. N. Talbot, Champaign, Ill.; Recording Secretary, S. A. Bullard, Springfield, Ill.; Treasurer, A. N. Talbot, Champaign, Ill.; Executive Board, A. H. Bell, A. N. Talbot, E. A. Hill, G. P. Ela, C. G. Elliott.

The next meeting will be held in Bloomington, Ill.

At the annual meeting of the Master Builders' Exchange of Philadelphia, on January 24, in the Exchange Rooms, Third and Walnut Streets, the following directors were elected for the ensuing three years: Stacy Reeves, George Watson, William II. Albertson, Fred F. Myhlertz, William C. McPherson, George W. Roydhouse, and J. S. Thorn; and William Gray was elected for unexpired term of two years. It was reported that the Exchange was in a very flourishing condition; over \$97,000 has been received during the year, portion of which was realized through the sale of bonds to purchase the Exchange's new building at a cost of \$75,000. In the evening a banquet was given at St. George's Hall by the Exchange, celebrating the first anniversary of their organization, at which over 350 persons were present.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
A MEETING of the society was held on February 1, 1888.
Vice-President J. James R. Croes occupied the chair.
A paper by S. H. Chittenden, M. Am. Soc. C. E., on
"Description of the Work of Constructing a Dam Across
the Potomac River for Increasing the Water-Supply of
Washington, D. C., was read and discussed by Messrs.
Croes, Hutton, Flagg and others.

The deaths of the following members were announced: Charles H. Fisher, of Lansingburg, N. Y.; Fred Mercur, of Wilkesbarre, Pa.; Frank Beresford, of Cincinnati, O.

The following standing committees were announced: On Finance, Stevenson Towle, Charles B. Brush, Mendes Cohen; On Library, J. James R. Croes, Alphonse Fteley, Joseph M. Wilson.

Professor Eadweard Muybridge, well known for his studies of the motions of men and animals by instantaneous photography was among the visitors, and after the formal exercises were concluded showed to the members a very interesting series of illustrations of his peculiar work.

The following gentlemen were elected:

As Members—Daniel Seymour Brinsmade, Envineer Ousatonic Water Co., Superintendent Shelton Water Co., and Agent Birmingham Water Power Co., Birmingham, Conn.; Lorenzo Russell Clapp, now Assistant Engineer Department City Works, Brooklyn, N. Y.; Frank Paul Davis, Assistant Engineer District of Columbia, and now on leave to act as Assistant Engineer District of Columbia, and now on leave to act as Assistant Engineer on surveys for Nicaragua Ship Canal, Washington, D. C.; Clarence Delafield, Hydraulic Engineer for S. R. Bullock, New York City; William Franklin Denois, Assistant Engineer Richmond and Danville R.R., Washington, D. C.; Edward Flad; Emil Gerber, Resident Fngineer Sioux City Bridge Co., Sioux City, Iowa; George Blagden Hazlehurst, Assistant Engineer B. & O. R. R., Baitimore, Md.; Allen Bogardus Hegeman, Contractor's Engineer Kansas City Extension, Chicago, Milwaulee and 5t. Paul R. R., Ottumwa, Iowa; Alexander Joseph Swift, Chief Engineer Northern R. R. Department Delaware and Hudson Canal Co., Albany, N. Y.; Elliott H. Wilson, engaged in general civil and mining engineering, member of firm Wilson & Gillie, Butte City, Mont.

As Juniors - Kayajiro Kobayashi, with J. A. L. Waddell, M. Am. Soc. C. E., Kansas City, Mo.; George E. Moulthrop, Assistant Engineor Montana Central R. R., Butte City, Mont.; Robert Ridgway, Assistant Engineer New Croton Aqueduct, in charge of Croton Gate House and Shafts o and I, Sing Sing, N. Y.

ENGINEERS' CLUB OF PHILADELPHIA.

THE regular meeting of the club was held January 21, 1888, President Joseph M. Wilson in the chair; twenty-four members and one visitor present.

The Secretary presented, for Mr. C. H. Ott, an accoun of a peculiar case of transmission of vibrations and pulsations through structures. Annoying, and even serious, vibrations, in this case, were found, by direct experiment, to be occasioned in a building at one end of a solid row 400 feet long, by the operation of a small engine running a spice grinder in a retail grocery store at the other end of the row.

A general discussion of vibrations in structures followed, participated in by a large number of members, and numerous instances were noted. Mr. John T. Boyd described vibrations, in a large office building, that had never been satisfactorily accounted for; Mr. Henry G. Morris, in a large hotel, created by the elevator pumps; Mr. Howard Murphy, the relative effects of the carthquake on different floors of an office building; Mr. F. W. Whiting, where the fourth story of a five-story mill building, in Philadelphia, vibrates $\frac{1}{2}$ 6 of an inch, and a mill building, in Massachusetts, where the vibration is so great as to cause nausea among new employees, and where the water cannot be kept in a fire bucket, yet the building is probably at least ten years old and seems to stand it.

Mr. Joseph M. Wilson referred to the evil effects of continuous vibrations in structures, and noted, incidentally, a case in his recent practice where large marble blocks had been broken by the freezing of water in the lewis holes; Mr. Howard Murphy referred to the vibration in the large Scotch stacks, and Mr. Henry G. Morris noted the case of a stack 125 feet high, where the vibration was 1½, inches. Messrs. Seaman, Haupt, Cleemann, Brown and Redway took part in the discussion.

Prof. L. M. Haupt submitted a few extracts from the Report of the Chief of Engineers with reference to the theoretical operation of submerged jetties, and made some comments thereon to show why the system had apparently not proven more successful.

Mr. A. Marichal presented a mathematical discussion of the theory of curved dams for the reference book.

Mr. F. W. Whiting noted a case in hydraulics, where attempt had been made to bring water in a pipe across an embankment, which had been unsuccessful until an opening was made at a point in the pipe 1 ne, and a small pipe extended therefrom to the level of the source.

Mr. Howerd Murphy suggested that the trouble had probably been caused because the hydraulic gradient had not been considered in the original location of the main pipe.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met January 18, 1888, President Holman in the chair; W. H. Bryan, Secretary; eighteen members and four visitors present. Malverd A. Howe was elected a member.

A communication from the Civil Engineers' Association of Kansas on the interchange of papers and proceedings was read.

Professor Johnson called attention to a pamphlet by J. A. L. Waddell on improvements in the construction of highway bridges. J. B. Johnson, Robert Moore, and N. Digitized by

W. Eayrs were appointed a committee to consider same with a view to endorsing the author's ideas.

Mr. N. W. Eayrs then read a paper on "The Improvement of Nantucket Harbor, Mass." The sandy coast rendered the work slow and difficult, as only the scouring effect of the tide was available. Great difficulties had been met with, but good results were already apparent. At the beginning a mean channel depth of only six feet was available. This had already been increased eighteen inches, and the plans contemplated an ultimate mean depth of twelve feet, and possibly fifteen. It was discussed by Messrs. Ockerson and Wheeler.

The secretary read a paper by Professor C. C. Brown, of Union College, Schenectady, N. Y., on "State Surveys." The author showed the great necessity for more careful and detailed surveys, their probable cost, and the best methods of undertaking same.

Professor Nipher exhibited another cast-iron cap burst by firing a rifle-ball into a cylinder of water, the bottom of which was closed by the cap.

Mr. Crow exhibited an improved form of radial draw-bar adapted for cable-car service.

PROPOSED NEW PHYSICAL UNITS.

M DE FREYCINET recently presented an interesting paper to the French Academie des Sciences, which is published in the *Chronique Industrielle* of November 27. Its object is to show that a modification of certain mechanical units will secure sensible advantages and a much more rational conception of physical properties.

Many authors establish a kind of logical relation between force, weight, and mass, but in order to clearly separate the ideas, it seems necessary to commence by defining the forces and masses and the velocities which the former communicates to the latter without considering the force of gravity and its effect on the bodies.

Imagine a body rolling without appreciable friction on a horizontal plane. If we represent by 1 the effort necessary to communicate a given velocity to a cubic decimetre of ice, the efforts required to communicate the same velocity to a cubic decimetre of iron, mercury, aluminium, etc, will be respectively 7, 14, 2½, etc.

The above determination of mass by applied force will always exactly coincide with values obtained by observing the action of gravity in a vacuum.

Mass is therefore very easily determined by weighing a body, since mass, gravity, and weight are, under the same conditions, all proportioned to one another.

The unit of length is the distance passed over in one second by a body moving uniformly at the velocity acquired in falling freely for one second of mean time in vacuo at Paris, equal to about 9.8 m. The unit of volume is a cube whose side is $\frac{1}{100}$ the unit of length, equ. 1 a out 0.94 litres. The unit of mass is the mass of water (at temperature of 4° C.) contained in a unit of volume. The unit of weight is the unit of force, and is the weight, at Paris, of the unit of mass. All other units are derived from these.

Let us call that property of a body by which it absorbs more or less dynamic force in acquiring a certain velocity in a given time its dynamic capacity; then two masses are dynamically equivalent when the same force imparts the same velocity in the same time to each mass. The dynamic capacity of iron being seven times that of water a cubic decimetre of iron is dynamically equal to seven cubic decimetres of water, and may, therefore, be considered to contain seven times as much matter, and the density of iron is seven times that of water. Mass and density are thus defined independently of the force of gravity, and their values can be determined by submitting a body to the action of a known force; this quantity and the observed acquired velocity will determine the required values. The dynamic unit results from the choice of a unit of length, or vice-versa. The characteristics of this system are (1) that the unit of length is founded on dynamic phenomena instead of being chosen arbitrarily and a priori from terrestrial lengths; (2) that the unit of mass is the unit of weight instead of being a multiple of that unit.

DISPOSAL OF SEWAGE AT SEA.

A STEAMSHIP costing nearly \$16.000 has been constructed to carry 1,000 tons at each voyage of the solid residuum of the London sewage out to the North Sea from the Barking Creek Sewage-Works. Four or five more such ships will be required to deal with the entire quantity.

NEW ENGLAND WATER-WORKS ASSOCIATION

THERE will be an adjourned meeting of this association at Young's Hotel, Boston, on Wednesday, February 15, 1888. The rooms will be open for members use at 11 o'clock. The association will not be called together until after lunch, which will be served promptly at 1 o'clock. The following is the topic for discussion: "Water Waste—with especial reference to the amount used during the winter months to prevent freezing."

Members are requested to present their individual experience relative to the increased demand during a series of cold days; the steps which they would have taken to check this abuse, and any other facts pertaining to the subject which may have occurred in their individual experience. Members are requested to notify the Secretary, R. C. P. Coggeshall, New Bedford, whether or no they will attend

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

An invitation has been extended to the society to hold the spring meeting of 1888 (XVIIth) in the city of Nashville, Tenn., which has been accepted. It will probably occur in the end of April or beginning of May. The manuscripts for the meeting should be sent in before March 17, 1888. As many of the papers as possible should be in print before that date, particularly if illustrated. Council meetings to examine applications for membership occur at the end of February and of March.

THE PROPOSED MUNICIPAL BUILDINGS IN THE NEW YORK CITY HALL PARK.

I ITTLE has been heard of that mistaken scheme to erect a couple of buildings adjoining the City IIall and the County Court-House since Assemblyman Crosby introduced his bill at Albany to prevent such a spoliation of the park. Yet the scheme is not dead; it only sleeps. Its advocates are apparently lying low in the hope that the Legislature will forget the Crosby bill and adjourn without passing it. The time within which architects' designs will be received by the Commissioners of the Sinking Fund on lines already laid down and circulated has been extended until April, and there is little doubt unless the Crosby bill is promptly passed that the city will be committed to their scheme. The bill should therefore be enacted without delay.—N. Y. Tribune.

OPENING OF THE MERCED IRRIGATION CANAL.

THE great Merced Irrigation Canal was formally opened Lebruary I. The canal was begun five years ago by Charles Crocker and C. H. Huffman. It cost \$1,500,000. It is twenty-seven miles long, 100 feet wide at the top, seventy at the bottom, and ten feet deep. It will irrigate 300,000 acres of the most fertile land in California. The great engineering features of the work are two tunnels, one 4.400 feet long, driven through the hill of solid rock, no supports being necessary; the other 3,000 feet long, faced with timbers. The dam across the small valley near Merced, constructed to form a reservoir, is 4,000 feet long, 275 feet wide, and 54 feet high.

PURCHASES OF STEEL RAILS FOR 1888.

Press dispatches from Pittsburg report that the railroad companies and the steam manufacturers have finally come to an agreement whereby the Pennsylvania Railroad have placed orders for 50,000 tons at \$31.50 per ton, to be divided between Cambria Iron Company, the Pennsylvania Steel Company, and the Carnegies.

The Chicago, Burlington, and Quincy Railroad has placed an order with Chicago mills for 20,000 tons at a somewhat higher figure. This would seem to indicate a resumption of business in these very important industries, and the prospect of further railroad building in 1888, all of which will benefit directly or indirectly many of our readers.

NATURAL GAS FOR TOLEDO.

THERE is before the Ohio Legislature a bill authorizing the city of Toledo to issue bonds to the extent of \$750,000, to be used in putting into operation and maintaining a system for additional supply of natural gas to the city. Mayor Hamilton, of Toledo, has addressed a remonstrance to the Committee on Municipal Affairs giving strong reasons against its passage.

PROFESSOR ASA GRAY.

PROFESSOR ASA GRAY, of Harvard University, died at his home, in Cambridge, Mass., January 30, aged seventy eight years.

The deceased was born in Paris, Oneida County, N. Y., and received the degree of M. D. at the College of Physicians and Surgeons for the Western District at Fairfield in 1831.

Professor Gray was a constant, earnest worker in original fields, where his contributions have been of great value. He was for more than fifty years a regular contributor and for twenty years editor of the American Journal of Science and Art.

He received in 1835 or 1836 the appointment of botanist to the Wilkes' South Sea Exploring Expedition, but resigned it and accepted the Chair of Botany in the University of Michigan, and soon after spent a year in scientific European research.

In 1842 he was appointed to the Professorship of Natural History at Harvard University and occupied that position until his death, although relieved during the last tew years of the duties of active teaching.

Professor Gray's writings embrace a long list of educational books and many scientific papers and essays. He devoted his life to the examination of North American flora and published a treatise on its relation to Japanese flora, which he indicates had a common Northern origin in the Tertiary Period.

In his death science loses one of its ablest workers and the world a noble spirit.

CHICAGO'S CITY ENGINEER.

(Special Correspondence.)

CHICAGO, February 1.—The office of Chief Engineer of this city no longer exists, Mr. Artingstall's resignation having been accepted by Commissioner of Public Works George B. Swift, who will at the same time, it is understood, reappoint him presently upon the staff as engineer to design and build bridges and viaducts. The appointment of Mr. F. W. Gerecke, of Newburg, N. Y., as engineer to look after the water-works engines, has also been made.

AN AUTOMATIC GAS-LIGHTER.

A. M WUSTER, of Ybbs, Austria, has invented a device by which street-lamps are automatically lighted and extinguished by the increase and decrease of pressure in the street-mains.

THE GANGES BRIDGE AT BENARES.

THE double-track railroad bridge over the Ganges at Benares, described in *Indian Engineering*, which was completed last October, was commenced in January, 1832, and consists of sixteen spans of a total length of 3,523 feet. Seven are of 356 feet each and nine of 114 feet from centre to centre of piers, some of whose foundations are 140 feet below low water, and contain 16,000 tons of material, all of which was carried to the work on coolies heads along a narrow floating staging. The spans are of steel lattice girders, 25 feet apart to centres, and the main ones are 35 feet deep. Altogether they weighed 6,405 tons. Two temporary piers were built in each of the main spans, and on them the short girders were temporarily placed to form a platform on which to erect the large ones.

Work was carried on day and night by electric lights' as it would have been otherwise impossible to get through such work as must have been completed to render the structure safe from flood during each season.

PERSONAL.

THE copartnership of Wilson Brothers & Co., of Philadelphia, civil engineers and architects, has expired. The old business will be settled by John A. Wilson and Joseph M. Wilson, and a new copartnership has been formed under the old firm name for the transaction of a general business as civil and hydraulic engineers and architects, by John A. Wilson, Joseph M. Wilson, Henry W. Wilson, Charles G. Darrach, and Henry A. Macomb, at 435 Chestnut Street, Philadelphia.

M JOR WILLIAM LUDLOW, recently relieved from duty as Engineer Commissioner, District of Columbia, has received the following letter from the President:

EXECUTIVE MANSION, WASHINGTON, Jan. 26, 1888.

To Col. Wil nam Ludlow, Commissioner, &c.

DEAR SIR: I have directed that Major Charles W. Raymond, of the Engineer Corps, be detailed as one of the Commissioners of the District of Columbia in your place, and he will, I suppose, at once relieve you as such Commissioner. The considerations which led me to make this change of detail do not involve the least lack of confidence in your ability or integrity, and I am glad to certify to your efficiency in the performance of your duty.

Yours very truly, GROVER CLEVELAND.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

LINCOLN, NEB.—Plans are wanted here, until February 21, for a county court house to cost about \$170,000. Address O. C. Bell, County Clerk.

SUMMERVILLE, MASS .- Plans are wanted here for a Masonic temple. Address the secretary of the lodge.

NEW YORK CITY .-- The Commissioners of the Sinking Fund have issued a notice to the effect that time for receiving plans, etc., for public buildings to be erected in the city hall park is extended from March I to April 2.

MILWAUKEE, Wis .- Plans are wanted here for a \$40,000 club-house for the Calumet Club. No date specified. Address Bunde & Up-meyer, 123 Wisconsin Street.

TRADE CATALOGUES.

THE Gurney Hot Water Heater Co., of THE Gurney Hot Water Heater Co., of 237 Franklin Street, Boston, Mass., have just issued a forty-page pamphlet entitled "Hot Water Heating," which they have copyrighted. The pamphlet explains the principles of hot water heating, gives hints to fitters, and is descriptive of the Gurney Hot Water Heater, for heating dwellings, offices, while heating consequently also public buildings, conservatories, etc. It also contains a number of testimonials from people who have used their apparatus, and will be sent gratuitously to those interested.



For works for which proposals are requested see also the "Proposal Column," pages i-v-vii-viii-159.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and rel able news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not eisewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

AMAICA, L. I .- The following communication, dated January 27, has been received from William E. Everitt, Town Clerk of this

place:
'The application of Floran Grosjean and others to supply the town of Jamaica with water was granted at a meeting of the Town Board and Highway Commissioners of said town, held this day, with the exception of within the incorporate limits of the village of Jamaica, over which they have no control, and which is now supplied by the Jamaica Water Supply Co."

FORT SMITH, ARK .- The Sewer Commissioners have issued a notice as follows: Finding that specified weights per foot and thickness of pipe will bar out the Akron, O., and other good brands of pipe, bids will be received on pipe a shade lighter and thinner if of equal strength and quality. J. P. Bates is the en-

NEW REDFORD, MASS. - Mayor Rotch has recommended the introduction of water-meters throughout this place to prevent the extreme waste of water which, he claims, at present prevails. He can give details.

FORT BENTON, MONT. - Several schemes for establishing a water-works system here are on foot, and it is probable that conclusive steps will be taken before long. It is proposed to expend about \$45,000 on the system. The City Clerk can give details.

SAN BERNARDINO, CAL .- Reports from here state that the trustees have accepted plans for a \$130,000 sewerage system.

OTTAWA, KAN.—It is reported that S. B. Christie, of Omaha, Neb., has plans for a sewerage system for this city.

WINNEPEG, MAN .- It is reported that the sewerage system of this city will be extended in the spring.

FRANKLIN, MASS .- Address the City Clerk for details of water-works construction here.

STORM LAKE, IOWA.-According to reports the water-works at this place are to be extended.

HAVANA, ILL.-The question of establishing water-works is being discussed by the tax-payers of this place.

SAUK RAPIDS, MICH.—Water-works will probably be established here.

Howell, Mich.-Water-works may be erected here.

HANOVER, MASS.—The Town Clerk of this place writes us, in answer to an inquiry concerning the reported water works project here, as follows: "I have heard a rumor that they talk of extending the water works to South Hanover from Rockland. No steps taken as yet.'

TAMPA, FLA.-Concerning the reported sewerage project here our correspondent writes as follows: "The establishment of sewerage system is contemplated here in Tampa, but as yet no steps have been taken."

SALT LAKE CITY, UTAH .- Concerning the sewerage question here our correspondent writes as follows: "The sewerage question course there has been no definite plan advanced yet."

NESS CITY, KAN.—R. Osborn, City Clerk of this place, writes us under date of January 17 as follows: "Voted for water works bonds yesterday. Amount, \$25,500."

WEST BAY CITY, MICH.—Concerning the sewer question here our correspondent writes sewer question here our correspondent writes as follows: "The issue of \$60,000 worth of bonds has been ordered. Sewer map to be submitted February 1, and as soon as location of sewer districts are decided upon proposals for labor and material will probably be received."

RIVERTON, NEB.—Concerning water-works matters here, our correspondent writes as follows under date of January 27: "The village of Riverton have on hand the hydrants, pipe, etc., for water-works Bonds of \$36,000 voted, but not sold. Will be issued in a few days."

MILFORD, N. H .- Concerning the waterworks project here our correspondent writes as follows: "The Milford Water-Works Co. organized January 25, 1888, with a capital of \$40,000; C. S. Averill, President; W. Ellis, Secretary—expect to put in works the present year; probably will pump from the Souhegan River."

ATLANTA, GA.—The City Council has appropriated \$55,000 for additional sewer con-

HILTON, N. C.—An artesian well is to be sunk here by the Clarendon Water-Works Company.

Avon. N. Y .- Orange Sacket, the Town Clerk of this place, writes us, under date of January 26, as follows: "On the 6th day of January last our village voted to establish waterworks at a cost not to exceed \$50,000. The Board of Water Commissioners has engaged Mr. E. D. Smalley, of Canastota, N. Y., to make the survey and maps, and to have general superintendence of the work. He will commence on Monday next. Proposals will be ready about the 1st of March."

ST. Louis, Mo.-Concerning the project to erect a set of new buildings here in connection with the water-works, M. L. Holman, Water Commissioner, writes us as follows: "Site for pumping-station purchased—forty acres. Negotiations in progress for about 200 acres for settling basins and route for conduit. Ordinance passed for employment of engineering force. Surveys for construction and plans expected to begin about March 1.'

FRANKLIN, MASS.—In reply to an inquiry concerning water-works matters here we get the following reply from the City Engineer: "New stand-pipe, 80x30 feet, of iron, in the spring.'

COLUMBUS. O.-The City Council has adopted a resolution directing the City Engineer, R. R. Marble, to employ an expert engineer to make an examination and report plans for a complete system of sewerage for the city.

[For other news under this heading see

page 159.]

BRIDGES.

RALEIGH, N. C.—Concerning the bridge project here, our correspondent writes: "We have advertised to receive bids on February 6 for the building of two bridges, and also to pay \$20 for the plan and specifications pre-sented which we may see fit to adopt. We are as yet undecided whether they will be of wood or iron. The width of roadway will be 12 feet in clear; no footway. Capacity of bridge, 1,000 pounds to lineal foot; length of bridges, between 200 and 300 feet."

RAILROADS, CANALS, ETC.

MILWAUKEE, WIS .- The surveyors on the Winona & Southwestern Railroad have found a good route from Winona, Minn., to Mason City, Iowa, and on to Council Bluffs and Omaha. The estimated cost is \$9,000,000, and the road will be 700 miles long.

SPRINGFIELD, ILL.—It is proposed to build a railroad from the city of Decatur, in the County of Macon, to Beardstown, in the County of Macon, to Beardstown, in the County of Cass; the capital stock is \$1,215,-000. The incorporators are: Robert B. F. Peirce and John S. Lazarus. of Indianapolis, and others. The principal office is to be maintained at Decatur

STREET WORK AND PAVING.

MONTREAL, CANADA.—A large section of the city will probably be repaved in the spring.

ATLANTA, GA.-The sum of \$75,000 has been appropriated by the City Council for paving and curbing.

GAS AND ELECTRIC-LIGHTING.

RALEIGH, N.C.—A new electric-light com-pany is to be organized in this city with Julius Lewis at its head. The new company will erect a plant at once.

SAUK CENTRE, MINN.—Henry Keller has been granted contract to light the town by electricity at \$1.50 per month per light.

ATHENS, TENN.-The Athens Mining and Manufacturing Co. will, it is reported, erect an electric-light plant here.

WASHINGTON, D. C.—It is reported that the Automatic Portable Gas-Works will erect an extensive plant here.

CHATTANOOGA, TENN. -It is reported that an extensive fuel-gas plant is to be established near this city.

GRACEVILLE, DAK.—Natural-gas has been struck here at 140 feet in an artesian well.

BUFFALO, N. Y .- Concerning the published report that a \$40,000 building was to be erected here for the plant of the Thomson-Houston Electric Light Co., an official of the city writes as follows: "We are at a loss to by what authority such a notice was l. The committee have come to no deciissued. sion as yet; have not even consummated a purchase of a lot, and have not employed any architect, and consequently have nothing new for them.

SHARON, PA.—The citizens of this place have subscribed \$15,000 for the formation of an electric light company here.

MANCHESTER, N. H .- The People's Gas Light Co., of this city, has closed a contract with Head & Dowst for the erection of a brick building at its works, to be used as a generating room. The building will contain a generator with a capacity for half a million cubic feet of gas a day, or double the quantity man-ufactured at present. It will contain a watergas plant.

SOUTH BOSTON, VA.—An electric light plant is to be established here.

BRIDGEPORT, CONN.—The Flectric Light Company will soon run a mercantile wire into East Bridgeport for the purpose of supplying merchants and others with incandescent lights.

TOLEDO, O .- It is reported that the George Sherman Company has decided to build a pipe line from the north-western oil fields to Toledo. The oil will be used mostly for fuel. It is proposed to construct a 4 inch line, which will give a capacity of about 6,000 barrels a day. This line, 30 miles in length, will cost \$75,-GOO.

RIVERHEAD, L. I.—The officials of this place are considering the electric-light ques-

NORTHPORT, L. I .- The question of or-RURIHPORT, L. 1.—The question of organizing an electric-light company for the purpose of lighting the streets and stores by electricity is being discussed, and the prospects are that the movement will be successful.

FAYETTVILLE, ARK.—The Fayettville Electric Light and Power Co. has been formed with a capital stock of \$30,000. E. B. Harrison is at its head.

HELENA, ARK .- The Helena Electric Light and Power Co. has been organized with James Summers as president. The Van Depoe system will be used.

ISLIP, L. I.—It is proposed to place an electric light plant at a point between this village and Bay Shore powerful enough to supply both places with arc and incandescent lights. Nothing definite has as yet been done.

MARTINSVILLE, VA.—J. E. Stovell can probably give details of an electric light project here.

GREENVILLE, MISS.—It is reported that the Greenville Water Works Company will establish an electric light plant.

BIDS OPENED.

PHILADELPHIA, PA. - Proposals for the supplv of gas-meters for the ensuing year were opened January 26 by Director Wagner. The bidders were:
For meters of three lights: Helme,

For meters of three lights: Helme, Mc-Ilhenny & Co., \$5.40 per meter; Harris, Griffin & Co., \$5.40: American Meter Com-pany, \$5.40: Goodwin Gas-Stove and Meter Company, \$5.40; McDonald & Co., Albany, \$5.45; Dickley, Lansley & Co., Baltimore,

\$5.45.
For five-light meters the first four firms each bid \$5.90 per meter and the other firms

\$6.95.
For the 10-light meters the bids were \$8.80 by Helme & McIlhenny, Harris, Griffin & Co., and the American Company: \$8.85 by the Goodwin Company and the Albany and Balti-

For twenty lights: \$11.75 by the four home For twenty lights: \$11.75 by the tour home firms and \$11.80 by the other two. For thirty lights, \$16.25 and \$16.30 respectively. For lorty-five lights: \$22.75 and \$22 80. For sixty lights: \$32 50 and \$32.75. For 100 lights: \$54 and \$54.60. For 150 lights: \$83.75 and \$84.50

\$84.50.
For 200 lights: Harris, Griffin & Co. and the American Meter Company bid \$117.50. the Albany and Baltimore firms bid \$119.

For 300 lights the bids were \$197.50 by the home firms and \$200 by the other two.

Helme & McIlhenny, Harris, Griffin & Co., American Meter Company, and the Goodwin Gas-Stove and Meter Company, all of this city, were of the six firms who bid December 13 last but whose hids were rejected and seemer. 13 last but whose bids were rejected and new proposals invited because of the similarity in the bids.

The bidders for rebuilding the stables at the Ninth Ward Gas-Works were: Thomas Garrison, \$19,000, to be completed in ninety days; C. McLean, \$15,200, to be finished by April 16; John D. Hart, \$15,531, time, three months; Allen B. Rorke, \$15,673, no time specified; William T. Wilkins, \$15,480, time, four months. The bid of Mr. Garrison was rejected as being too high, and that of Mr. Rorke because no time was given. The de-The bidders for rebuilding the stables at the Rorke because no time was given. The department estimate for the work was \$12,000.

The contract was awarded to Helme & Mc-

I he contract was awarded to Heime & Mc-Ilhenny, Harris, Griffin & Co., the American Meter Co., and the Goodwin Gas-Stove and Meter Co.

TRENTON, N. J .-- Synopsis of bids for lighting the public streets, opened January 27 by the Common Council:

Wheeler Reflector and Light Co. proposed to furnish light (occlusive to the council)

to furnish light (coal oil) at \$19.75 per lamp

per vear.
Pennsylvania Globe Gas Light Co. proposed to furnish light at various figures from \$16.50 to \$23.50 per lamp, according to the kind and quality of the material.

The contract was awarded to the Pennsylvania Company, they to furnish the \$23.50 lamp (naphtha) which has been used by the city during the past two years and which has given general satisfaction.

JERSEY CITY, N. J.—The following proposals for the erecting of a compound pumping-engine at the High-Service Water-Works, to have a daily capacity of 5,000,000 U. S. gallons, have been received by the Board of Works:

Holly Manufacturing Company, of Lockport, N. Y., \$31,300, \$20,000, and \$17,000, for three different classes of high-duty pumps respectively.

respectively.

H. R. Worthington, New York, \$30,500. This includes improvements to the boiler-plant in order to secure the increased steampressure necessary.

The Davidson Steam-Pump Company, New York, offered to erect a compound pump for \$22,400, or an improved triple-expansion engine for \$26,500.

Each of the bidders submitted his own

plans and specifications. Commissioner Van Keuren questioned the legality of their course, Commissioner Van and the Corporation Counsel will be asked to decide the matter. The bids were laid over under the rules.

HILLSBORO, ILL.—The contract for constructing a system of water-works for this place has been let by the City Council to the Beloit Wind-Engine Company, of Beloit, Wis. The works will cost about \$20,000 when completed. Work will begin as soon as the weather will permit.

KANSAS CITY. Mo.—Synopsis of bids for

KANSAS CITY. Mo.—Synopsis of bids for constructing 900-foot viaduct, opened January 28 by John Donnelly, City Engineer:

Keystone Bridge Co., Pittsburg, \$34,900; The Pittsburg Bridge Co., Pittsburg, \$27,575; Atlanta Bridge and Axle Co., Atlanta, Ga., \$26,500: Milwaukee Bridge and Iron Works, Milwaukee, \$26,400; Penn Bridge Co., \$25,-290; P. E. Lane, \$26,666; Kansas City Bridge and Iron Co., Kansas City, \$27,984; Wrought Iron Bridge Co., Canton, O., \$22,500, awarded; King Iron Bridge and Mfg. Co., Cleveland, O., \$25,646; Columbia Bridge Co., \$25,192; A. J. Tullock & Co., Leavenworth, Kan., \$27,900.

The contract for constructing masonry in the piers and abutments in the foundation of the viaduct was awarded to James Murray at \$4,320.20. Other bids were as follows: E. C. Coolidge, \$8,665.91; Andrew Keating, \$5.282.75; M. Walsh, \$6,668; Keefer & Fisher,

282.75: M. Waish, \$0,000; Keeler & Fisher, \$4,,425.40.

The contract for half the viaduct was awarded by the Public Improvements Committee to J. W. Hoover, of the Canton, O., Wrought Iron Bridge Co., who bid \$22,500. The contract was restricted to one-half the work, as the appropriation, \$28,000, is not work, as the appropriation, \$28,000, is not seem to be appropriated to the best of the product of the best of the product of the base of the product of the base of the product of the base of the product of the base of the product of the base of the product of the base of the product of the base of the product of the base of the product of the base of the product of the product of the base of the product of the base of the product of enough to complete the viaduct, which is to be sixty feet in width and to consist of a double roadway and two avenues for foot passengers.
Under this contract but one roadway and one passenger avenue will be built.

NEW YORK CITY.—Synopsis of bids for removing the pier at the foot of West Thirty-eighth Street and for preparing for and building a new wooden pier and approach, and for repairing the existing crib bulkhead thereat, opened January 27 by the Department of Docks. The engineer's estimate was as follows.

Class 1, crib bulkhead: new crib-work complete, about 6.750 cubic feet; yellow pine plank, about 2,133 feet, B. M.; wrought-iron dock spikes, about 166 pounds; excavating, etc., about 225 cubic yards; labor of framing,

etc., about 225 cubic yards; labor of framing, carpentry, etc.

Class 2, new pier and approach: yellow pine timber, about 452,382 feet, B. M.; labor.

Bidders: P. Sanford Ross, class 1, \$1,275; class 2, \$48,700. Richard Cronin, class 1, \$1,120; class 2, \$45,790. John W. Flaherty, class 1, \$1,375; class 2, \$54,700. William P. Kelly, class 1, \$1,375; class 2, \$54,700. William P. Kelly, class 1, \$1,375; class 2, \$53,000. John Gillies, class 1, \$1,075; class 2, \$48,410. John G. Haskings, class 1, \$900; class 2, \$55,000.

BOSTON, MASS.—The only bid received by the Superintendent of Streets on January 28 for building the Boylston Street bridge was from the Boston Bridge-Works, whose proposal was \$47,200. An informal bid was sent by the New Jersey Iron and Steel Company for \$45,500, but it was not considered. The work will be done by the Boston Bridge-Works.

WILLIAMSPORT, PA .- In opening bids for sewers last week the two lowest bidders had not made their proposals in conformity with specifications; therefore, all the bidders will be given another opportunity or a new letting will be declared.

ROCHESTER, N. Y.—Abstract of proposals for furnishing cast-iron water-pipe and specials received January 26 by Thomas J. Neville, Clerk of Water-Works:

_							
	160 net tons. 48 " 77 " 112 " 10,000 lbs	Quantities.					
	160 net tons. 12-inch straight pipe 48		Items.				
	27.50 27.50 28.50 29.00 29.00	Prices bid.	Ruffala Cast Ison				
\$11,927.50	\$4,400.00 1,320.00 2,104.50 3,246.00 290.00 475.90	Amounts.	Buffalo Cast-Iron Pipe Co., Buffalo, N. Y.				
	29.40 29.40	Prices bid.					
\$12,056.5	\$4,480.00 1.344.00 2,194.50 3,202.80 204.00 451.25	Amounts.	Donaldson Iron Co., Emaus, Pa.				
	\$28 65 28.65 28.65 28.65 28.65 28.55	Prices bid.					
\$12,206.80	\$4,584.00 1.375.20 2,206.05 3,208.30 28.50 546.25	Amounts.	R.D.Wood & Co., Philadelphia, Pa.				
	\$29.50 29.50 29.50 29.50 29.50 29.60	Prices bid.					
\$12,505.25	\$4,720.co 1,416.co 2,271.50 3,304.cc 295.co 498.75	Am ounts.	McNeal Pipe & Foundry Co., Burlington, N. J.				
	\$29.70 29.70 29.70 29.70 29.70 29.70 2.3c.	Prices bid.					
\$12,524.90	\$4,752.00 1.425.60 2,280.90 3,326.40 297.00 437.00	Amounts.	Detroit Pipe & Foundry Co., Detroit, Mich.				
	\$25.96 29.96 29.96 29.96	Pr.ces bid.					
\$12,692.47	\$4,793.60 1.438.08 2,305.92 3.355.52 200.60 498.75	Amounts.	Gloucester Iron- Works, Philadelph a. Pa.				
	7,000,000	Prices bid.					
\$12,732.50	\$4,800.00 1.440.00 2,310.00 3,360.00 300.00 522.50	A mounts.	Mellert Foundry & Machine Co., Reading, Pa.				
	\$31.10 31.10 31.60 31.85 31.85	Prices bid.	I1 6 W				
\$13,311.70	\$4,976 co 1.402.50 2,413.20 3,519.20 338.50 132.00	Amounts.	Jackson & Woodin M'f'g Co., Berwick, Pa.				

NEW YORK CITY .- President Bayles, of the Health Department had received no bids for dredging in Mott Haven Canal up to the date advertised for opening the same, and, therefore, the work will be readvertised until March 1.

DALLAS, TEX.—The following were the successful bidders, and contracts have been awarded them by the city of Dallas, on exten-Lally & Son, Detroit, Mich., excavating reservoirs, river work, conduit and pump well, \$85,000; The Holly Manufacturing Company, Lockport, N. Y., pumping engine, \$29,000,

BROCKVILLE, ONT.-Synopsis of bids for 16-inch submerged sewer-pipe, 950 feet long, opened January 18 by Willis Chipman, Engineer: J. F. Ward, Jersey City, \$4.80 per lineal foot; Logan & Doddridge, Brockville, \$6.20 per lineal foot; M. H. Lefebvre, Montreal, \$6.45 per lineal foot. Contract awarded to J. F. Ward, the pipe, joints and castings furnished the contractor by the commissioners.

GOVERNMENT WORK.

WASHINGTON, D. C .-- Synopsis of bids for machine tools for Bureau of Construction and Repair, Navy Department, to be delivered at Brooklyn, N. Y., opened January 16 at the Navy Department. The following were the bidders and amounts:

Manning, Maxwell & Moore, New York: Class 1, \$2,950; class 2, \$2,650, class 3, \$1,-680; class 4, \$785; class 8, \$1,475; class 12, \$1,784; class 23, \$440; class 24,\$276; class 31, \$275; class 32, \$310; class 33, \$350; class 34, \$195; class 35, \$237,50; class 36, \$259; class 37, \$160; class 38, \$203; class 39, \$184; class 40, \$245.

B. F. Sturtevant, Boston, Mass., 23, \$850. R. A. Robbins, New York: 24, \$237.60; 30, \$989; 31, \$436.90; 32, \$597; 33, 295; 34, \$174.25; 35, \$211.75; 36, \$218.75; 37, \$181; 38, \$227; 39, \$195.84; 40, \$317.80; 41, \$577; 42, \$193.80; 43, \$239.40; 44, \$110.40; 45, \$167.20; 46, \$60.78; 47, \$10.20; 48, \$384. Putnam Machine Co., Fitchburg, Mass.: 11, \$2,753.50; 31, \$330; 33, \$212.50. Manning, Maxwell & Moore, New York:

Putnam Machine Co., Fitchburg, Mass.: II, \$2,753.50; 31, \$330; 33, \$212.50.

Donegan & Swift. New York: 12, \$630; 18, \$1.600; 19, \$1,575; 24, \$201.31; 26, \$900; 31, \$215.32; 32, \$155; 34, \$131.25; 35 \$156.25, 36, \$196; 37, \$150; 38, \$208.60; 39, \$176; 40, \$229.25; 41, \$517; 42, \$176.20; 43, \$192.48; 44, \$88.02; 45, \$137.50; 46, \$49.50; 47, \$7.42; 48, \$346.

Bennet, Miles & Co., Philadelphia, Pa.: 1, \$3,150; 2, \$3,150; 3, \$1,800; 4, \$850; 5.

Bennet, Miles & Co., Philadelphia, Pa.: 1, \$3.150; 2, \$3.150; 3, \$1.800; 4, \$88.0; 5, \$4,200; 6, \$6,950; 7, \$2.400; 8, \$1.575; 11, \$4.440; 12. \$1,600; 13, \$700; 14. \$650; 15, \$0.500; 16, \$6,750; 18, \$1,750; 34, \$105. James W. Soper, New York: 18, \$119; 19, \$980; 33, \$177.50; 34, \$105; 35, \$116.25; 36, \$157.30; 37, \$800; 38, \$105; 30, \$171.84; 40, \$219.10; 41, \$566.50; 42, \$187.28; 43, \$235.08; 44, \$93.48; 45, \$145.42; 46, \$53.16; 47, \$970; 48, \$370.

Forsaith Machine Co., Manchester. N. H.: Forsattn Fractine Co., Manchester. 1. 1. 1. 1, \$3,180; 2, \$3,080; 3, \$2,450; 4, \$935; 5, \$2,350; 6, \$4,600; 12, \$934; 17, \$2.156; 19, \$1.750; 24. \$237; 33. \$412.50; 34. \$246.75; 35. \$296.75; 36, \$278.25; 37, \$167; 38.

\$227.50. Niies Tool-Works, New York: 1, \$3,184; Nies Tool-Works, New York: 1, \$3,184;
2. \$3,c60; 3, \$1,960; 4. \$922; 5, \$4,450; 6. \$6,000; 7, \$2,100; 8, \$1,592; 9, \$3,530; 10, \$3,245; 11, \$3,300; 12, \$1,700; 13, \$850; 15, \$7,000; 16, \$5,950; 17, \$4,250; 21, \$2,500; 25, \$2,200; 26, \$850; 27, \$2,050; 28, \$3,730; 29, \$4,700.

Fraser & Archer, New York City: 31,\$249; 32, \$220; 41, \$516.50; 42, \$163.20; 43, \$180; 44, \$84; 45, \$127.05; 46, \$45.30; 47, \$6.16; 48, \$2.70; 49, \$12,950.

Robert Wetherill & Co., Chester, Pa., 49, \$9,700.

\$9,700.
Lidgerwood Manufacturing Co., New York,

19, \$1,880.

Builders' Iron Foundry, Providence, R. I.,

25, \$2.750. The Pratt & Whitney Co., Hartford, Conn.:

31. \$414: 33, \$400; 34. \$353.

John Swan & Co., New York: 33, \$325;
34. \$193.75: 35, \$231.25; 36, \$295.75; 37.
\$183.80; 38, \$233.80.

Excelsior Tool Co., New York: 36, \$203;

37, \$180; 38, \$224.

LEAVENWORTH, KAN .- Synopsis of bids for plumbing, water and gas piping for Court-House, opened January 30 by the Supervising Architect of the Treasury Department: Frederick A. Miller & Son, \$4,868; James Foley, \$5,000.

KEY WEST, FLA.-Synopsis of bids for KEY WEST, FLA.—Synopsis of bids for general excavation and piling for Custom-House, etc., opened January 30 by the Supervising Architect of the Treasury Department. Amount for performing the work according to specifications and drawings: McDermott & Higgs, \$10,647.17; Colin McK. Grant, \$14,000; George W. Egan, \$11,400. McCarthy & Baldwin, \$13,880; Kelly Bros., \$12,950. If piles creosoted, additional, Colin McK. Grant, \$5,000: George W. Egan, \$3,000. Uncreosoted piles, delivered only, George W. Egan, \$9,000. Creosoted piles, delivered only, \$6,800.

WASHINGTON, D. C .- Synopsis of bids for WASHINGTON, D. C.—Synopsis of bids for furnishing broken stone, cement, sand, firebricks or granite, opened January 23 by James Fulton, Paymaster General, U.S. Navy.

Broken stone—John A. Bowker, New York, 40c.; W. H. B. Stout, Lincoln, Neb., \$8.40; John McClinchot & Bro., Port Deposit, Ind.,

43c.; George B. Clarke, Washington, D.C. 39½c.; J. W. Gaskill & Sons, Philadelphia, Pa., 47c.

Pa., 47c.

Cement—J. G. & J. N. Waters, Georgetown, D. C., \$1.12; H. W. Blunt, Washington, D. C., 90c.; George B. Clarke, Washington, D. C.; \$1.10; J. W. Gaskill & Screen St. 10. Sand—George B. Clarke, 4%c., and John B. Lord, Washington, D. C., 4c.; Henry C. Young, Baltimore, Md., 11c.; E. E. Burroughs, Washington, D. C., 6c.; Robert Miller, Washington, D. C., 6c.; R

Young, Baltimore, Md., 11c.; E. E. Burroughs, Washington, D. C., 6c.; Robert M. Miller, Washington, D. C., 4½c.; J. W. Gaskill & Sons, 15c.

Fire-bricks—George D. Clarke, \$31.6q: S. M. Hamilton & Co., \$30: George L. Neville, Portsmouth, Va., \$44.74; J. Edward Bates, Washington, D. C., \$26.46; E. J. Griffith, Norfolk, Va., \$30 25.

Granite coping and steps—Brandyvine Granite Co., Wilmington, Del., \$1.123.40; P. F. McAuliff and Peter C. Kelly, Washington, D. C., \$1,624.20; Gill & McMahon, Bainmore, Md., \$1.175; John Lane and Malnate, Washington, D. C., \$1,545; W. H. B. Stoul, Lincoln, Neb., \$1,235; John Burns, Washington, D. C., \$1,632; Berry & McFredetick, Baltimore, Md., \$1,416.64; M. Gault & Son, Baltimore, Md., \$1,416.64; M. Gault & Son, Baltimore, Md., \$1,53; Cuthbert & Walker, Washington, D. C., \$1,688.75; John McClinchot & Bro., Port Deposit, Md., \$1,150,93; Westham Granite Co., Virginia, \$1,30,45; Davidson & Son, Chicago, Ill., \$1,527. Nicholas Nothwell & Son, Washington, D. C., \$1,60c; J. W. Gaskill & Sons, Philadelphia, Pa., \$2,007.

Block tin—George L. Neville, Portsmouth.

Pa., \$2,007.
Block tin—George L. Neville, Portsmouth.
Va., 50c.; E. J. Griffith & Co., Norfolk, Va., 44.9C.

TOO LATE FOR CLASSIFICATION.

OSCEOLA, FLA.-Water-works are projected

CUBA. N. Y .- The citizens of this place are agitating the water-works question, and it is probable a system of water-works to cost about \$50,000 will be built.

TROY, ALA.—Our correspondent writes from here as follows: "A new system of waterworks, capable of supplying 5,000 people and live stock, is contemplated. Mayor Charies Henderson, Troy, Ala., can give full partic-

NEW ROCHELLE, N. Y.—At a recent meeting of the Citizens' Committee to whom had been referred the matter of providing plans for sewering the place, plans were adopted, and it was agreed to send them to the Legislature for the enactment of a bill permitting the village to go ahead with the work at once.

CHATHAM, VA .- Address the Mayor for particulars of water-works project here.

FARMINGTON, CONN. -- There is a reported water-works project here.

PETERBORO, ONT.—It is reported that a system of sewers will be constructed here.

CANTON, O .- The city officials are considering the question of improving the sewerage

UTICA, N. Y.—It is reported that a reservoir is to be built here.

JERSEY CITY, N. J.—The water-supply question was agitated at a meeting of the Board of Public Works held February 1, and a resolution directing the Clerk to advertise for proposals for a supply of pure and whole-some water was passed. Chief Engineer Ruggles had prepared the necessary specifications. The water is to be delivered in the High-Service reservoirs, and the contract, if awarded, is to run for ten years.

The contractor is to be required to keep the

pumps, reservoirs, and mains at Belleville and on the Hackensack meadows in perfect repair. In addition to the usual bonds the successful bidder is to be required to deposit \$500,000 in cash in a bank to be designated by the city as an additional precaution.

ROGERS, ARK.—It is reported that water-works are to be erected here and that Messis. Graham & Mason are interested.

EUSTIS, KAN.—Arrangements are being made to establish a system of water-works

FLUSHING, MICH.—The question of establishing an electric-light plant is being agitated here.

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ROCKDALE, TEX .- Water-works are being

FARMVILLE, VA .- The City Council has decided to illuminate the public streets by electricity.

SHARON, PA.—This place has subscribed \$15,000 to the Sharon Electric-Light Com-, which will immediately proceed to supply the town with light.

BURLINGTON, IOWA.—A bill providing for a railroad, foot. and wagon bridge to be built across the Mississippi River at this place has been passed by the Senate.

NEW YORK CITY.—Synopsis of bids for iron-work, steam-heating, and plumbing in the erection of an Armory Building for the Eighth Regiment, opened by the Armory Board, January 30: Iron-work—James Curran, \$12,220; Verti-

Ton-work—James Curran, \$12,220; Vertical Tube Boiler Co., \$13,985; Jacob Jamer, \$13,395; Baker-Smith, \$12,278.

Plumbing—George Hickenbothen, \$9,397; John Renehan, \$9,500; John Regan, \$17,989; John Spencer, \$9,100; Christopher Nolly, \$7,795; P. J. Andrews, \$8,833; George Cody,

\$8.300.

The following amounts include the above together with the masonry and carpenter

Isaac A. Hopper, \$284,490; James A. Brady, \$298,986; E. D. Conelly & Son, \$201,350.

The contract was awarded to Isaac A. Hopper.

CHICAGO, ILL.—Synopsis of bids for conopened January 31 (postponed from the day previous) by the Department of Puolic Works:

Quintard Iron Works, New York—Two en-

gines, each to be of three beams, with triple expansion cylinder, to be 16 inches, 25½ inches and 44 inches in diameter, with 8 feet stroke. The pumps are to be vertical, single-

acting plunger pumps, 21½ inches in diameter, 8 feet stroke. Price, \$185,000.

Holly Manufacturing Company, Lockport, N. Y.—Two No. 7 pumps, Gaskill engines, with six boilers, etc., \$83,500; or, two No. 8

Gaskill pumps, \$98,500; or, two vertical pumps, \$93.500.

William Wright Company, Newburgh, N.Y.

—Two sets of triple cylinder compound engines, six horizontal drop return tubular boilers.

boilers, \$113,993.

Henry R. Worthington, N. Y.—Three bids were submitted at \$92,055, \$94,555, and \$107,-055. respectively.

The contracts will not be awarded till January 9.

SANDUSKY, O.-Svnopsis of bids for furnishing, etc., a pumping engine for the water works, opened January 31, by the Water

Knowles Steam Pump Works, N.Y-5,000. ooo gallons, low duty, \$26,000; 7 500,000, gailons, low duty, \$38,000; amount allowed

for old pump, \$1,000.

Henry R. Worthington, New York City.— 5,000,000 gallons, low duty, \$19,750; 7,500 000 gallons, low duty, \$22,750; 5.000,00 000 gallons low duty, \$22,750; 5.000,000 high duty, \$29.500; 7,500,000 gallons, high duty, \$31.750; 5,000,000 gallons, high duty, with boilers, \$25,500; 7,500,000 gallons, high duty, with boilers, \$34.500; amount allowed for old pump, \$4,000.

Holly Manufacturing Company, Lockport,

Holly Manufacturing Company, Lockport, N. Y.—5,000,000 gallons, low duty, \$12,500; 7.500,000 gallons, low duty, \$16,500; 5,000,000 gallons, high duty, \$21,500; 7,500,000 gallons, high duty, \$28,000.

Deane Steam Pump Co., Holyoke, Mass.—5,000,000 gallon, low duty, \$26,400; 7,500,000, low duty, \$34,000; on other propositions, \$30,000, \$41,000, \$39,000, \$24,000, \$31,700, \$20,000. \$29,000.

NEW YORK .- The Assembly Committee on Ways and Means has given a hearing on the bill appropriating \$50,000 for dredging the Hudson River from Troy to Castleton. The object of the measure was to increase the width of the channel between Troy and Albany to 140 feet, and between Albany and Casileton to 175 feet.

LANCASTER, PA .- The Lamp Committee of City Councils met January 17, and opened bids for lighting the city, beginning June 1, 1838, as follow

United States Electric-Light Company: For 132 electric lights, or more, 2,000-candle power each, for one year, for 35 cents per lamp per night, and for three years at the rate of 34 cents per lamp per night.

The American Electric Light Company:

Lights of 2,000-candle power at the rate of 35

cents per lamp for one or three years.

The Edison Electric Light Company: First, to light the Mayor's and Treasurer's offices. Council Chambers, station-house and markethouses with 24-candle power incandescent lights for \$5 per annum for a period of one or three years; second, to furnish, erect, and maintain on the lamp-posts now lighted by gas, and erect new ones where necessary, 24candle power incandescent lights at the rate of \$20 per light per year for one year, and \$18 each for three years; third, to furnish, erect, and maintain posts at all points in the city, including the territory now lighted with coaloil, gasoline, and other material, and place thereon 24-candle power incandescent lights for \$20 per lamp for one year and \$18 per lamp for three years.

Pennsylvania Globe and Gas-Light Company: To light the street lamps with gasoline of from 16 to 18 candle power for \$24 per lamp per year for one year, and for \$22.50 lamp per year for three years, and furnish all

lamps and posts at their own expense, the same to remain their property.

Lancaster Gas-Light and Fuel Company: To furnish the gas at the Mayor's office, s tion-house, markets, council chambers, and fire engine houses for one year for \$1.75 per 1,000 cubic feet, light the street gas-lamps for \$26 per lamp per year, furnish new lamp-posts and lamps at \$18 each complete, the lamps to be not less than 16-candle power. For a three-year contract will furnish gas for \$1.60 per 1,000 cubic feet, light the streets for \$24 per lamp per year, furnish lamp-posts for \$18
apiece. Providing the lamps in the middle of squares be used, which will add 300 new lamps to those already lighted by gas, and add an annual consumption of 6,000,000 feet to the amount now consumed annually, gas will be furnished for street lamps at \$1.60 per lamp per year. The award was postponed.

PROPOSALS.

(Continued from page viii.)

WATER-WORKS.—Proposals are wanted at Chatham, Va., for a complete system of water-works. No date specified. Address E. S. Reid.

HOTEL.—Proposals are wanted at Chattanooga, Tenn., until April 1, for building the North Athens hotel, for the Athens Mining and Manufacturing Company, at Athens, Tenn. Address I homas C. Veale, architect.

DREDGING DOCKS.—Proposals are wanted at Philadelphia, Pa., until March 7, for dredging docks on the Pelaware and Schuylvill Rivers, not belonging to the city, into which public sewers emp y. Addres George A. Cotton, President Board of Wardens, Por of Philadelphia, Pa., Room 11, Chamber of Commerce

WATER WORKS.—Proposals are wanted at Herkimer, N. V., until February 18, for the construction of a complete system of water works, according to sociclic tions. Address W. B. Howell, President, Water Works Commission.

PUMPING ENGINES.—Proposals are wanted at Findiay, U., until February 15, for furnishing two compound, non-condensing, direct acting pumping engines, each of 2,500,000 gallons pumping capacity, together with boilers, etc., necessary to complete said machinery. Address F. Karst, of the Water Works Trustees.

PIPE, CASTINGS, HYDRAN'IS, ETC.—Proposils are wanted at Findlay, O., unt.! February 15, for furnishing 2,650 tens cast-iron water pipe, different sizes, 11,000 pounds spec al castings, 107 stop valves, 137 6-inch fire-hydrants, 2 4-inch fire-hydrants, and 107 cast-iron stop boxes; also, the labor connected with the placing of the above. Address F. Kaist, of the Water-Works Trustees.

IRON DRAW.—Proposals are wanted at Green Pay, Wis., until February 9, for the construction of an iron draw, complete, in place of a wooden one, the length to meet the approaches on either side. Address O. J. B. Brice, City Clerk.

BUILDING MATERIALS.—Proposals are wanted at Fort lotten, Ramsey Connty, Dakota, unul February 25, for turnishing for delivery at the Devil's Lake Agency, Dakota, a variety of building materials consisting of about 71,000 feet of assorted lumber, 10,800 feet shiplap, 16,000 feet sheathing boards, 11,600 feet flooring, 3,800 feet of feeling, 50 M. shingles, 30 M. laths, windows, doors, lime, hair, bricks, and a variety of nails, paints, oils, etc., required in the construction of all addition to a school building. Address John W. Cramsie, U. S. Indian Agent, U. S. Indian Service, Devil's Lake Agency, Dakota.

LUMBER.—Proposals are wanted at the office of the Board of Fire and Police Commissioners, Taxing District, Shelby Co., Tenn., until February 9, for furnishing all lumber for the enginer department, such as curring, bridge timbers, and culvert coverings, to be used during the year 1888. Address David P. Hadden, President, as above.

MACHINE TOOLS.—Proposals are wauted at Washington, D. C., until March 1, for furnishing the nece4sary material and labor, and constructing 16 16-inch gun lathes, and for the delivery and errection of the same in the Navy Yard, Washington, D. C. Address D. B- Harmony, Acting Secretary of the Navy.

WATER-FILTER, Erc.—Proposals are wanted at New Orleans, La., to furnish a water-filter and tele-phone s-rvice for the use of the Marine Hospital S. r-vice, in this city. No date spec fied. Address Passed Assistant Surgeon, 14. H. S., in charge of Hospital.

PROPOSALS.

BRIDGE SUPERSTRUCTURE.—Proposals are wanted at Toledo, O., until February 28, for sub and superstructure of a ron bridge over the Ottawa River, in this city. Address M. J. Cooney, County Auditor.

BUILDING WALL.—Proposals are wanted at Aluany, N. Y., until February 8, for building about 200 feet of vertical wall and setting back the abutments on Beach Street Bridge, in the city of Syracuse. Address James Shanahan, Superintendent of Public Works.

DREDGING AND PIPE-I.AVING.—Proposals DREDGING AND PIPE-I.AYING.—Proposais are wanted at Pittsburg. Pa., until February 28, for dredging and laying about 6,000 feet of 18-nch pipe, a.d. 4,000 feet of 8-nch pipe at Marinette, Wis. Plans, specifications, and profiles will be furnished on application. Address American Water-Works and Guarantee Co., Ltd., Pittsburg, Pa.

PUBLICATIONS RECEIVED.

SEWAGE TREATMENT, PJRIFICATION AND UTILIZATION, A Practical Manual for the use of Corporations, Local Boards, Medical Officers of Healtn, Inspectors of Nussances, Chemists, Manufacturers, Riparian Owiers, Fingineers, and Ratepayers, By JW. Slater, F. F. S. London: Whitisker & Co., Paternost r Square, New York: D. Van Nostrand, 23 Murray Street.

TWELFTH ANNUAL REPORT of the Water Comm.ssioners of the city of Taunton, Mass. William R. Billings, Superintendent. November 30, 1887.

NEW CORPORATIONS.

THE Electric Supply Company, of Springfield, Ill.; for the purpose of manufacturing fire and burglar alarms and other electrical apparatus; capital, \$50,000; incorporators, Andrew Scuchman, Robert B. Hoover, and Frank W. Wellman.

THE Cowers Dredging Company, Chicago, Ill.; capital stock, \$200.000; incorporators, A. L. Amberg, I. W. Bates, and H. A. Christy.

THE Jewell Pure Water Company, at Chicago, Ill; capital, \$500,000; for the manufacture of water-filters, etc.; incorporators, Frank F. Fisher, James McLean, and William De-

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; s s dwell, brown-stone dwelling; apart house, apar neni-house; fen, tenement: e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

N s cor 56th, 175 e 2d av, br flat and store; cost, \$22,000; o, F Heerline; a, Berger & Bayles.

17 Suffolk, bk ten; cost, \$14,000; o, David T Wright; a, J. Boekei & Son.

S s 124th, 80 e 5th av, bk flat; cost, \$22,000; o, Peter Fuchs; a, Cleverdon & Putzel.

S w cor 121st and 7th av, 3 bk flats; cost, \$120,000; o, John D Taylor; a, A. B Og-

S s 121st, 85 w 9th av, bk flat; cost, \$45,000; o, John D Taylor; a, A B Ogden &

S s cor 51st, 125 w 9th av,bk flat; cost, \$20,-000; o, Andrew Ewald; a. Thomas Wilson.

S w cor Baxter and Franklin, bk flat; cost, \$22,000; o, Louis Levy; a, Fred Ebeling.

23d st. Nos 524 532 W, rear, I bk laboratory; cost, \$13,000; o, Consolidated Electric Light Co; a, A Page Brown; b, L A Burke &

53d st, n s 100 e 10th av, 1 brick factory; cost, \$8,000; o, Ruth A Wallace; a, Henry

Lexington av, n w cor 96th st, 1 bk flat and stores; cost, \$28,000; o, Harnett & Deery; a, J. C. Burne,

Lexington av, ws 25.11 n 96th st, 3 bk flats and stores, cost, each. \$16,000; o, a, and b, same as last.

ALTERATIONS-NEW YORK.

N w cor Broadway and 54th, bk stores and offices; cost, \$15,000; o. Richard S. Ely; a, Carl C Pfeiffer.

Park row, s w cor Spruce and Nassau, bk office bldg; cost, \$600,000; o, New York Times; a, George B Post.

322 and 324 Broadway, office bldg; cost, \$15,000; o, Central National Bank; a, John Sexton-

Cortlandt st, No. 14; cost. \$6,500; lessees, New York Real Estate and Building Improvement Co; a, George E. Harney. Building Im-

BUILDING INTELLIGENCE.

BROOKLYN.

Macon st, s s 155 w Lewis av, 2 b stone dwe!l; cost, each, \$9.500: o and m, J F Sullivan; a, H Vollweiler.

117-119 George, 2 fr dwells; cost, \$8,500 all: o, W Wahl; a, Frank Holmberg.

271-273 Magnolia, 2 fr dwells; cost. \$8,600 all; o, Frank J Burghardt; a, David, Acker &

N s Kosciusko, 200 e Reid av, br stable; cost, \$8,000; o, C F Spencer; a, A W Dicken.

MISCELLANEOUS.

READING, PA.—Eighth and Court st, 3-story br bldg Y M C A; cost, \$40,000; o, Y M C A.

KANSAS CITY, MO.-Nothing over \$7,000 in value to report.

WORCESTER, MASS.— Nothing over \$7,000 to report this week.

BALTIMORE, MD.—Nothing over \$7,000 in value to report.

KANKAKEF, ILL. - Lutheran Church. stone, to cost \$20,000; a, F. A. Schlager.

LOWELL, MASS.-Nothing over \$7,000 in value to report.

PITTSBURG, PA.—The Western Theological Seminary, on Ridge av, will expend \$15,000 in building an addition to the structure

GRAND RAPIDS, MICH.-Corner Bostwick and E Bridge, St Mark's Home, brick, with stone trimmings; cost, \$40,000; o, St Mark's Church; a, N G Robinson; b, contract not let.

Just outside city, Masonic Home Building, brick, stone trimmings; cost, \$75,000; o, Masonic Home Association; a, S J Osgood; b. contract not let.

DETROIT, MICH. - McDougal!, fr church cost, \$7,000; o, St Philip's Society; a, E E Meyers; b, R Helson.

LOS ANGELES, CAL.-4-story brick and stone business bldg; cost, \$25,000; o. Miss R Lee Noble; a, Peters & Burns; b, not

2 dwellings costing less than \$7,000.

DAYTON, O.—2-story pres br and s dwell; cost, \$7.500; o, J R Fletcher; a, Peters & Burns; b, not let.

PROVIDENCE, R. I. - Friendship and Page, 4-story br manufactory; cost,\$15,000; o, H Remington; a, R Manchester. 6 permits for less than \$7,000.

RIPON, WIS .- The Trustees of Ripon College have decided to expend the sum of \$50,000 on improvements and the erection of a gymnasium.

WINONA, MINN.—The Chicago, Milwau-kee and St. Paul Railroad Company will erect a large depot in the early spring.

EVANSTON, ILL.-The Free Masons of this place have decided to erect a \$20,000 temple.

NORTH ATHENS, TENN.—Woodward av. pressed br hotel, stone, hardware, tiles, marble, stained glass, plumbing, heating and electric work, complete; cost. \$45,000; o, Athens Mining and Manufacturing Company; a, Thomas C. Veale; b, Patten & Bradshaw for stone foundation. Bids for the rest received until April 1, 1888.

SIDNEY, O .- Anderson, Frazer & Co. will erect car wheel works to cost \$25,000.

NIAGARA FALLS, N. Y.—The New York Central Railroad Company will build a \$25,000 depot here.

EAU CLAIRE, WIS.—C. W. Chappell will erect a \$10,000 block of stores here.
BOSTON, MASS.—No permits for work exceeding \$7,000 were issued during the past week.

WILLIAMSPORT, PA .- J R T Ryan will erect three brick stores and dwellings, and P B Shaw will erect three brick stores as soon as weather permits

FLUSHING, L. I .- Address Edward Rath for particulars of a building project to erect a number bldgs at this place.

ST. LOUIS, MO .- Nine permits have been issued valued under \$7,000.

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BUILDING INTELLIGENCE.

- ALLEGHENY, PA .- Nothing new overthe value of \$7,000 to report this week. Building outlook for spring dull.
- ST. LOUIS, MO.—Seven permits have been issued for buildings valued under \$7,000.
- KALAMAZOO, MICH.—Fr dwell; cost, \$7.500; o. H C Reed; a, S J Osgood; b, De Graaf & Hendrick
- ATLANTA, GA.—A \$40,000 public building, and a \$15,000 school-house are to be erected here.
- ST. PAUL, MINN.—An insurance block is to be erected by the Germania Life Insur-ance Company of New York. It is reported that \$500,000 will be expended on it. Plans are being made.

The Pioneer Press daily newspaper is to have a new building to cost \$400,000.

- SAULT STE. MARIE, MICH.—John O. Plank and others are interested in a project to erect a \$300,000 hotel at this place.
- COLUMBUS, O .- Address the City Clerk for details of the school-house to be erected here at once.
- MILWAUKEE, WIS.—Fowler, near 18th, br foundry; cost, \$10,000; o, J. G. Wagner. South west cor Grand av and 18th, br ven dwell; cost, \$10,000: o, C A Beck; a, R G Kirsch & Co; b, F L Vogel & Sons. 9th, br club house; cost, \$40,000; o, Calumet Club.

Secor 3d and State, 3 story br store; cost, \$12.000; o, Harry Guenther; a, A C Clas; b, open.

675 Cass, br dwell; cost, \$11,000; o, Ignatz Friedman; a, A C Clas; b, open.

- LAKE CITY, MINN.—Barracks for the encampments of the Minnesota national guards will be erected.
- KANSAS CITY, MO.—Plans are being pre-pared by Chief Engineer Knight for an engine house for the Eighteenth Street Cable Railway Co. It will be of brick, stone, and iron, and will cost \$150,000. Address him for details.
- CHICAGO, ILL.—846-54 Walnut, br dws; cost, \$15,000; o. Foskett & Brown; a, G Gressing; b, owner

La Salle and N Watersts, at the river, 4-story br warehouse: cost, \$35,000; o, West-ern Refrigerating Co; a, W W Boyington;

Same place, 4-story warehouse; cost, \$45,-000; o, Western Warehousing Co; a, and b, same as above

854-58 Milwaukee av, br stores, offices, and flats; cost, \$30,000: o, Le Grand Perce; a, Seely; b, A Lanquist

Dearborn st, below 24th, br flats; cost, \$60,000; o, Henry W Martin; a, C A Weary

Dearborn and 23d sts, br flats; cost, \$50,-000; o and a, same as above

Wood, nr Harrison, br and stone apartment block; cost, \$50,000; o, A W Hatfield; a, D Seymour

Hermitage av, br and stone apartment block; cost; \$40,000; o, same as above; a,

York st, bet Hermitage and Wood, br and stone apartment block; cost, \$60,000; o and a, same as above

W 21st and Robey, br store and dw; cost, \$11,000; o, Wilhelm Heinrich; a, Aug

Ashland av, just north of Twelfth, lime-stone church, with 180-foot tower; cost, \$50,000; o. Emanuel Lutheran Church; a, Fred Ahlschlager

35 buildings costing less than \$7,000

PHILADELPHIA, PA.—Walnut st, west of Broad, 5-story stone club house; o, Manu-facturers' Club; b, Allen B Rorke

Prospect and Gleason, 5 2-story dws and 1 stable; o, Ernest Ragnor

- 1.ITTLE ROCK, ARK.—Ash and 25th, 2-story br residence, slate roof; cost, \$7,000; o, C W Clark; a, B J Bartlett
- HARRISBURG, PA .- Walnut st, offices of the Sunday Telegram; cost. \$15,000; o, Telegram Newspaper Co; a, Smith & Waruer; b, A Hughe

BUILDING INTELLIGENCE.

- TALLAPOOSA, GA.—For details of \$10,-000 hotel, address the Tallapoosa Land, Mining, and Manufacturing Co., of this city, or Col. Geo. W Adair
- SEVEN MILE BEACH, PA-A large hotel is to be erected here from plans made by Architect W E Jackson, 506 Walnut street, Philadelphia, Pa
- DENVER, COL—According to reports a steel car plant is to be established in this city J W Nesmith, and others, are interested
- GRAND RAPIDS, MICH.—Terrace av, fr dwell; cost \$7,000; o, and a, S J Osgood; b, J F Macery

Washington st, fr dwell; under construction; cost, \$8,000; o, S B Jencks; a, S J Osgood; b, Richens & Stearnes

Lagrave st, br church, under construction; cost, \$12,000; o, Fourth Christian Roformed; a, S J Osgood; b, J Rosema

MUSKEGON, MICH.—Foundation in br blk; cost. \$50,000; o, L J Mason; a, S J Osgood; b, contract not let.

Cherry st, Hard heads and pressed br bld; cost, \$25,000; o, E C Fox; a, N G Robinson; b, Contractor not known at

- WHITESTONE, L. I.-Fifty dwellings are to be erected here in the spring. Address the President of the Improvement Society for details.
- CANTON, O.—Three new school-house are to be erected here. Address President Barlet, of the Board of Education, for de-
- PUEBLO. COL.—Architect Stovens, of this city, has plans for a \$50,000 city hall, to be erected here. Address him for details.
- YANKTON, DAK.—Two wings are to be added to the insane hospital here at a cost of \$90,000.
- LOWELL, MASS.—Nothing over \$7,000 to report.

DETROIT, MICH.—Baltimore, br dwelling: cost, \$7,000; o, G. A. Whitney; a, Hess & Raseman; b, P. Cook.

McElliott, br dwell; cost, \$7,000: o, Munz; a, Hess & Raseman; b, L Reh-

berg.
Dequindre, br shop; cost, \$9.000; o, M J Murphy & Co; a, Scott & Co; b, H

210 Campan, br dwell; cost, \$9,000; o, H. Carew; a, Scott & Co; b, H Carew.

DUBUQUE, IOWA—Eighth & Pine st, Dubuque Water Co will build a pumping station; cost, \$20,000; o, Dubuque Water

PASADENA, CAL.—Raymond av, fr hotel: cost, \$75,000; o, Pasadena Improvement Co; a, Eisen, Cutlett & Co.

Fair Oaks av, br block; cost, \$45,000; o, Mr Doty; a, Fred Rochrig; b, George Webster.

Fair Oaks av, br block; cost, \$40,000; o, Y M C A; a, as above.

Colorado, br block; cost, \$20,000; o, Steven's Hardware Co; a, as above.

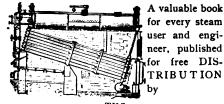
The above buildings are partly planned and partly built. The excavation for other large brick blocks are commenced.

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Harper's Magazine

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Socialism in London.

By J. H. Rosny, Ten Illustrations by Franceice Barnahd;

The Tariff.

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Editor's Study.

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INTERNATIONAL CONGRESS FOR THE IMPROVEMENT OF INLAND NAVIGATION.

THE announcement on another page of the meeting of the Third International Congress for the Improvement of Inland Navigation to be held next August at Frankfort-on-the-Main will be of much interest to all our engineering readers, and especially to those who have had to do with similar work in this country. It is earnestly to be hoped that this interest will soon take some practical shape that may result in sending suitable and sufficient representatives to the approaching congress. There is no country more largely interested than our own in the improvement of inland navigation, and perhaps none in which more extensive works have been accomplished, if the South Pass, the Erie Canal, and Hell Gate may be taken as fair examples.

If proof were needed of the former assertion, some, at least, is given in the letter of Captain Bixby in another column, showing the great benefits derived from comparatively small sums expended to improve the inland waterways of two of our South Atlantic States, and on the latter point a European estimate of the value of our experience in such matters may be found in the unexampled fee paid to Mr. Eads for his advice in regard to the Mersey Canal mentioned by our correspondent.

A due regard, therefore, for our national interests, as well as an international esprit du corps, will prompt our various engineering societies to seasonably arrange to acquire as well as to contribute all the information possible on this important occasion, and our National Legislature should be early memorialized to take suitable measures for adequate representation and the display by maps and models of our most characteristic and important works.

MUNICIPAL ENGINEERING PICNIC EXCURSIONS.

In a recent number of the *Builder*, under the title "A Sanitary Hitch," the large expenditure for sanitary purposes in England, amounting, in cost of plant and works, to over four hundred millions of dollars, and in present annual outlay to about seventy-five millions, is declared to be steadily increasing, while the results obtained are inadequate. The main cause of this undue and unnecessary cost of municipal engineering works for sanitary purposes is ignorance on the part of municipal authorities. When public part of municipal authorities. When public opinion as to the sanitary condition of a town, the impurity of its water-supply, or the need for a system of sewers, becomes so far aroused that the authorities feel called on to do something, one of the first steps taken, according to the Builder, is that "a deputation is appointed, consisting, for the most part, of wholly inexperienced persons, to go round the country and see what other people are doing. Time, no doubt, in one sense of the word, is thus gained; in another sense it is lost, and money too. In one instance the results of such expeditions, and of the subsequent deliberations on them, has been the expenditure of £90,000 on outfall works for 11,000 persons, with the effect of producing an intolerable nuisance."

Like causes under like circumstances produce like effects, and the spectacle of a special committee of some board of aldermen or town council traveling about the country to investigate the merits of sewage systems or waterworks, or patent pavements, is by no means a novelty on this side of the Atlantic. The result, when there is any, is usually that the committee advises the authorities to do what they ought to have done in the first place-viz., to appoint an expert engineer, or a commission of experts, to advise as to what should be done.

These picnic excursions of municipal committees do not, as a rule, lead to the construction of improper works, as in the case referred to by the Builder; in fact, as a rule, they lead to nothing, except delay and unnecessary expense. It is true, however, that they have some educational value, and when they result in convincing a board of aldermen that expert advice should be obtained, it may be that the result is worth the cost. It seems a pity that the work has to be done over again so many times, but there is probably no help for it. When a city has legal business, or has to provide for its sick, the authorities do not consider it advisable to investigate for themselves the merits of law vs. equity, or to send out a traveling committee to compare homœopathic with other hospitals and dispensaries; but the education of most City Fathers has not got so far as this in relation to doubtful points of municipal engineering. The "chorus of interested advice," as the Builder terms it, is loud and incessant, and if the choice is to lie between the picnic excursion and the rushing through a job contract, it must often happen that the first is the lesser evil.

SHIP-RAILWAYS—ANCIENT AND MODERN.

UNDER this title Harper's Monthly for February contains a very interesting article by F. L. Hagadorn, giving a brief historical sketch of what men in all ages have, for purposes of war and commerce, done in the way of overland transport of ships, and a glance at what is now being done and proposed in the same line, the whole illustrated with several maps. We only give a few of the leading points of what will well repay careful reading.

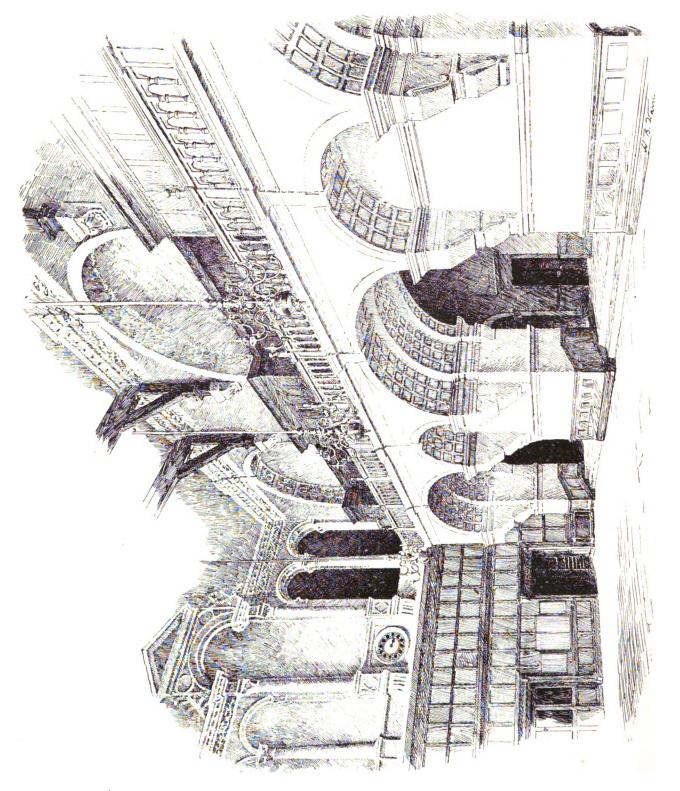
To go back to the "cradle of civilization," it seems that even from prehistoric times the natives of Corinth were skilled in dragging vessels of all kinds across the narrow isthmus, where, subsequently, 550 B. C., the Athenians built the "Dioclus," or haul-over, a veritable ship-railway of polished granite provided with suitable cradles and rollers, which they operated for three hundred years, often carrying war vessels of an average length of 150 feet and a displacement of at least 450 tons.

In the fifteenth century the Venetians, under the direction of an engineer named Sorbolo, in barely six weeks carried a fleet of thirty vessels fifty miles overland from the River Adige to Lake Garda, crossing Mount Peneda on the way, in order to relieve the city of Brescia, then besieged by the Milanese.

The road had to be prepared as they went, and at least six of the vessels were nearly as large as those handled two thousand years be-fore by the Athenians on the "Dioclus," requiring 600 oxen each to haul them out of the water and half that number to move them on the land, as they were fully loaded with cannon and munitions of war and with supplies for the beleagured Digitized by GOGIE



ENDOWMENT ASSOCIATION BUILDING, WASHINGTON, D. C.—GLENN BROWN, ARCHITECT.



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INTERIOR, EXAMINATION SCHOOLS, OXFORD, ENGLAND.

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At the present time a ship-railway is about to be constructed across the isthmus of Chignecto, at the head of the Bay of Fundy, by Sir John Fowler.

The Canadians have also under consideration a project for a ship-railway from Toronto on Lake Ontario to Georgian Bay, an arm of Lake Huron.

In our own country Major Jones, of the U. S. Engineers, has designed a ship-railway to avoid the dangers of the Dalles on the Columbia River, in Washington Territory, and his plans are now under consideration by the War Department.

Another ship-railway has been projected across the peninsula of Michigan, from Michigan City to Toledo, and still another across the Florida peninsula.

As regards the feasibility of these ship-rail-way projects, if it be said that but little can be argued from previous successes in that line on account of the small size of the vessels handled, it should be answered that the difficulty of handling such a large body lies not so much in its size or weight as in its relative weakness, which renders it proportionately more liable to injury, and if it can be shown, as there should be no difficulty in doing, that modern metal ships are stronger in proportion to their size than those handled by Sorbolo and the Athenians, the difficulty vanishes.

When one considers the superior strength and durability of metal, and how much more firmly it is possible to unite plates and bars of iron than planks and ribs of wood; what hard treatment the vast "Great Eastern" sustained uninjured during her launch when she rested for some time practically on two points only; how seldom, if ever, an iron vessel succumbs to the fury of the waves alone, as wooden vessels have not unfrequently done, it does seem as if there should be little question of the ability of modern engineers, with all the mechanical resources of the present day, to handle the largest vessels, which are always metal, with perfect safety on the dry land, where they were built and whence they were launched into their miscalled "native element," with much less care than will be taken on any well-managed ship railway.

It was such considerations as these that inspired the lamented Eads to undertake his gigantic project of an inter-oceanic ship-railway at Tehuantepec, now in the hands of his able associate, E. L. Corthell, as chief engineer, of which we cannot say more than to indorse the following comment of the London Times: "This scheme is a bold one, but it is not more remarkable for its boldness and originality than for its engineering soundness and for the perfection with which every detail has been worked out and every possible contingency provided against."

OUR ARCHITECTURAL ILLUSTRATIONS.

INTERIOR OF EXAMINATION SCHOOL, OXFORD, ENG.—

T. E. JACKSON, ARCHITECT.

A BUILDING AT WASHINGTON, D. C.

THE subject of our vignette illustration this week is the building of the Beneficial Endowment Association at Washington, D. C. It is built of brick, stone, and terracotta. First story in cherry, the others in white pine, all polished. The architect was Mr. Glenn Brown, of Washington, D. C.

A FRENCH VIEW OF THE PANAMA CANAL.

In connection with the impartial account drawn from official sources by Lieutenant C. C. Rogers, U. S. N., so fully presented in our issue of January 28, the editorial statements and data in the *Genie Civii* of January 21 are of timely interest. The different divisions and the nature of the work are described much the same as by Lieutenant Rogers, but the estimate of remaining excavation is 135 million metres, instead of De Lesseps' 105 million and Rogers' 125 million.

In view of the great difficulties, time, and expense that are mevitable in carrying out the original scheme of a sealevel route it has been determined to construct a provisional route with five or six different levels, to be used,

however, only until the completion of the original deep cut.

The line of the canal will not be much changed; sealevel will be maintained from Colon to kilo 22.7 and from kilo 59.1 to the Pacific, the backbone of the Cordilleras being surmounted at the formidable Culebra division by a summit level of 38m., reached by flights of four locks at each end, of 8m. and 11m. rise.

The arrangement is not yet fixed in detail and further investigation and conditions of water supply may cause modifications; some consideration is given to the plan of fixing the summit level at 49m. by adding a fifth lock of 11m. rise to each flight. This will make the natural water supply, which is assured for the 38m. level, unavailable during several months at least in the year, when it will have to be pumped from the 40m. to the 50m. plane at an expenditure of about 3,600 H. P. The available supply is from the basins of the Chagres, Obispo, and upper Rio Grande Rivers, with a total drainage area of about 200,000 hectares.

The section between the locks will be the same as in the sea-level portion. The locks will have an available length of 180m., with gates 18m. wide, and are to be built of metal, by M. Eiffel, engineer of the 300m. tower.

The speed of a ship in transit is estimated at 10 kilos per hour through long and 3 kilos through short levels, and about one hour is required for each lock; a single ship then can pass from ocean to ocean in 17½ hours and one of a fleet in 28½ hours. Ten ships a day are estimated, which at 2,000 tons burden each gives 9,125,000 per year, against the required capacity of 7,500,000.

The estimated water required for lockage, and losses by evaporation, filtration, etc., is 10 cubic metres per second.

THE ARCHITECTURAL LEAGUE.

THE PLANS OF A ROMAN PALACE.

THE Architectural League held its regular monthly dinner and meeting at Morelli's, 4 West Twenty-ninth Street, on the evening of the 6th inst., with the President in the chair.

A committee was appointed to enter protest, in the name of the league, against the conduct of the municipal building competition upon its present lines; also a committee to report upon the advisability of the league's taking permanent quarters, and the ways and means to the same.

Mr. E. R. Tilton read a most interesting paper on "Life in a Roman Palace." Mr. Tilton was born in the Barberini Palace, and lived there most of his life, and his description of its plan, with the numberless secret stairways, rooms, passages, and closets, and the queer discoveries made in them, was very entertaining. His paper was illustrated by a plan of the part of the palace occupied by his family, which plan showed so little thought in planning that, although the lease covered twenty rooms, twelve of these had to be used to reach the other eight.

UTILIZING THE SEWAGE OF PARIS.

THE French Chamber of Deputies has just adopted a bill authorizing the utilization of the sewage of Paris for ferti'izing purposes, with a view to purifying the Seine. There was also a proposition before the Chamber for the construction of a covered sewage canal from Paris to the sea, with reservoirs, for the benefit of farmers requiring the sewage for fertilizing.

POISONED BY SEWAGE.

A DISPATCH to the New York Times states that the whole ship's company of a vessel lying at Philadelphia are seriously ill from drinking polluted water. The man who had contracted to fill their tank from the city mains took the water from the river instead, near the outlet of a large sewer. Analysis shows the dangerous character of the water, and the probabilities are that had the ship gone to sea all hands would have perished. Detention by the ice alone prevented it. It would be gratifying to hear of the severe punishment of this contractor.

VALUABLE MAPS OF LAND UNDER WATER.

DUPLICATE maps, made by Civil Engineer Burrus in the office of the Secretary of State, of the entire shore line of Kings County, bound in atlas form, are now finished and on file, and a map of Richmon I County is well under way. As the maps are compiled from the records of the State Department, and when necessary from actual surveys, they are of untold value, and will in the future become valuable records in themselves.

REPORT OF SECRETARY OF WAR FOR 1887 ON ENGINEERING PROJECTS.

In the report of the Secretary of War for 1887, we find a few items which are of interest to engineers.

The appropriation bill for rivers and harbors having failed, the department finds itself in the anomalous condition of having no funds with which to pay for the surveys and examinations required at the South Pass of the Mississippi before they can certify as required by law to the maintenance of the channel. The amount paid Eads or his representatives up to September 30 was \$5,450,000, leaving an amount yet to be paid under certain conditions of \$2,550,000.

The masonry dam across the Potomac for the new watersupply of Washington was completed in August, 1886. It is 2,877 feet long and 4 to 20 feet high. The tunnel excavation has been completed, and the masonry lining finished for 8,767 feet, leaving 11,929 feet, nearly all of which must be lined. This increase in the quantity of lining requires an increase of \$320,000 in the estimates for completing the work.

There have been 5,314,000 cubic yards of material excavated and deposited upon the Potomac Flats, thus raising 461 acres of marsh to a height of 4 to 10 feet above mean low tide. The cost thus far was \$985,341, and the cost of completing the improvement is estimated at \$1,441,365.

A 12-inch breech-loading rifled cast-iron mortar, hooped with steel has been completed and tested. With a charge of 65 pounds of hexagonal powder and a shell of 625 pounds, and an elevation of 45 degrees, a range of 9,385 yards was obtained, and still better results are obtained with brown prismatic powder of American manufacture.

The test of the 8-inch breech-loading steel rifled gun has progressed; 102 rounds have been fired with charges up to 113 pounds of brown pewder and shot as high as 302 pounds weight. The highest pressure reached in the chamber exceeded 40,000 pounds per square inch, and after the one-hundreth round no appreciable enlargement and no erosion were perceptible. The ballistic result exceeds that of any published result from guns of like calibre.

At 3,000 yards, the centres of all shot-holes were contained in a circle 61/2 feet in diameter.

The forgings for one 8-inch and one ro-inch B. L. steel rifle have been received and accepted. Those for the 8-inch were from the Midvale Steel-Works, the jacket and tube forgings being the largest steel forgings yet made in this country. This result was reached by them only after repeated failures, owing to inadequacy of plant, but there will be less difficulty in the future.

The forged hoops for the 10-inch gun were made by the Cambria Iron-Works, and the high standard of excellence demanded by the specifications were fully complied with.

The jacket, tube, and trunnion-hoop for this were procured from Joseph Whitworth & Co., of Manchester, England.

The need of enlarged appropriations for heavy ordnance is dwelt upon, also of a more thorough drill of the men in this branch of the service.

The gauging of the lower Mississippi is likely to be intermitted unless the appropriations for it be regularly made.

The dynamite torpedo-gun is favorably mentioned, also an electric fuse by which the shell may be ignited through contact with salt water.

The Signal Service is mentioned favorably, and attention called to the fact that it has become so far a scientific institution, that it is better to continue it as such and omit all military instruction. The Army has ceased to rely upon it, and now provides its own instruction in military signaling. It has been hampered in its proper work through insufficient appropriations.

A HUGE HYDRAULIC LIFT.

THE existing water communication between the Bristol Channel and Worcester by means of the Gloucester and Berkeley Ship Canal and the canalized River Severn between Gloucester and Worcester is navigable for vessels carrying two hundred tons, so that the necessary improvements to enable vessels of that class to navigate to Birmingham are upon the Worcester Canal about twenty nine miles in length only. The total lift from the River Severn at Worcester to the summit level at Birmingham is about 425 feet; and this, the London Engineer says, is proposed to be accomplished by twelve locks of 14 feet lift each, and by a hydraulic machine with a lift of 257 feet.

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THE PERLIN METROPOLITAN RAILWAY. No. II.

(Continued from page 150.)

The Foundations.—Good sharp sand was encountered within a few metres of the surface, excepting in a few exceptional locations which were originally old water-courses and where the sharp sand was encountered at greater and very variable and irregular depth with overlying strata of peat. The depth of foundation was fixed at a level of about 10 metres below the level of the rails, and of the total length of 7,964 metres of viaduct structure 4,593 metres are founded on masonry direct, 773 are founded on masonry between sheet-piling, 6,33 metres are sunk to a lower level and founded on masonry direct, and 559 metres are founded on piles.

The Piers.—The piers were divided into abutments, intermediate piers, and cluster piers. The abutments vary extremely, as almost every street crossing showed a different ground plan, and the different styles of superstructure required different treatment in the development of the masonry of those piers. The intermediate piers were very uniform in their construction and generally of a trapezoidical form and normal to the line of the road. The cluster piers were arranged at every fourth or sixth arch.

Arches.—The arches were generally of 12 metres span, 2½ metres rise, 55 centimetres thickness, and curved to a radius of 8¾ metres. Their ground plan was almost invariably rectangular. Oblique arches were re-

ings of 18 metres, measured at right angles; the arches are each built of 11 concentric rings of masonry, eight of which carry the four tracks. The separate rings of masonry are carefully and substantially anchored to each other with heavy iron anchors built in the masonry.

The bridge, inclusive of the two three-cornered land piers, covers a surface of 1,300 square metres, contains 7,040 cubic metres of masonry, inclusive of concrete foundations, and cost complete 250,000M. (493M. a square metre). The other stone bridge crosses the canal at right angles and has one opening of 24 metres. It is a flat, circular-arched bridge, covers a ground surface of 500 square metres, contains 2.850 cubic metres of masonry, inclusive of the concrete foundations, and cost 110,000M. complete, or 222M. per square metre. Of the four iron bridges, one is an iron arched bridge crossing the Spree. It has a clear opening of 48.15 metres and two adjoining street crossings of 15.05 and 10 metres respectively, clear width with a row of columns upon each of the curb lines. The arched bridge trusses are arranged in pairs, two for each track. It covers 1,560 square metres surface, contains 890,300 kilograms of iron, and cost complete 410,000 M., or 264 M. per square metre. The next is the bridge over the canal-basin; it is the largest bridge on the line. It has five openings of approximately 29 metres clear span. The piers were limited in size by the authorities on account of the valuable water-space, and were founded on piles, each pile being loaded with 20 tons and the masonry of the foundations loaded with 30,800 kilograms per square metre.

iron floor-beams. The weight of the superstructure is 275,700 kilos; the total cost of the bridge 199, 200 marks, or 187 marks per square metre.

THE ROAD; SIGNALS.

The roadway is built on the Haarmann system, which is so generally used upon German railroads. The rail is of steel of the Vignole type, 16½ feet long, and weighing 60 pounds to the yard. It rests on a stringer stamped from a metallic plate, which is one foot wide at the base, and 2½ inches high. This stringer is completely imbedded in the ballast. The rails are fastened to the stringers by bolts and fastened together by cross-ties.

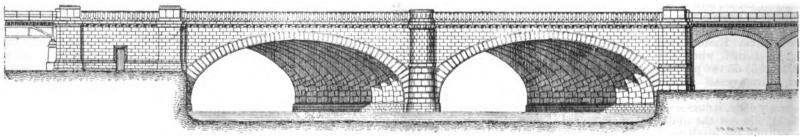
Moving trains are protected by the block system in general use upon the German railways. The signals consist of semaphores with movable arms, and are of the Siemens system.

TRACTION, ROLLING STOCK, MOVEMENT OF TRAINS.

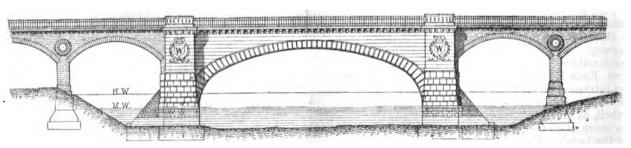
The locomotives in use upon the local service of the Metropolitan Railway are provided with a tender and have four wheels coupled. Two types differing very little from each other are used.

The oldest have a weight of forty tons, equally distributed upon three axles. They are provided with a condenser, and with an arrangement of the fire-box, and an exhaust which avoids the production of smoke or escape of steam.

The engines more recently put into service weighthirtysix tons. They have no condenser, experience having proven that no inconvenience arises from allowing the steam to escape while traversing the city.



BRIDGE OVER THE SPREE.



BRIDGE OVER A CANAL.

sorted to in a few isolated cases only. On top the arches had a course of hollow brick-work carefully arranged for drainage and air circulation. The drainage was carried off through the centre of the piers. All arched masonry was covered with a water-proof layer, generally a preparation of felt and asphaltum specially manufactured for this purpose.

On top of the arched masonry the viaduct was finished with low retaining-walls on either side, which served to confine the materials of the road-bed and to support the coping on which a railing is erected. The latter varies greatly in style according to the section of the city through which the viaduct passes. The road-bed consisted originally of sand at the bottom and gravel on top, with iron ties bedded into it. The layer of sand at the bottom has not worked well on account of retaining too much moisture.

Materials.—The masonry of the foundations and of the piers and arches was of brick laid in hydraulic cement. The masonry was carried up plain, with little attempt at ornamentation, and only at street crossings of where the viaduct ran parallel to a street for some distance the architectural appearance of the structure was improved by stone trimmings, cornices, and recessing of the masonry.

Bridees.—The River Spree is crossed three times, the canal twice, and a canal-basin once. Of these six bridges, two are entirely built of stone; the others are built of stone piers and iron superstructure.

The first Spree crossing, which is on a curve of 300 metres radius, is built entirely of stone; it has two open-

are built of brick-work, dressed with basalt lava, which reaches down to low water. The iron superstructure consists of two main trusses for each track, with parallel cords, single triangular web system, and riveted joints, with transverse girders at each panel point. The longitudinal stringers resting on the transverse girder are trough-shaped and filled with gravel, in which the rail-carriers are bedded. The weight of the entire superstructure amounted to 851,850 kilos. The surface covered by the bridge is 2,800 square metres; the total cost of the bridge, including foundations and masonry, 498,000 marks, or 168 marks per square metre.

The Spree crossing at Bellevue crosses the river at an angle of 45 degrees; it has three openings of about 17 metres in the clear. The superstructure consists of four main girders, one under the centre of each of the four tracks. They are single intersection lattice girders of 2.8 metres depth and 3.7 metres panel distance. They carry the transverse girders upon the upper chord at the panel points, so arranged and braced as to divide the superstructure longitudinally into two parallel bridges, carrying two tracks each. The piers are built of masonry, with foundations carried to considerable depth and founded on concrete. The total weight of the superstructure is 384,200 kilos. The bridge covers a surface of 1,202 square metres. The total cost of the bridge is 225,950 marks, or 176 marks per square metre.

The bridge over the Kupfergraben has two spans of 26½ metres each. The iron superstructure consists of two hinged arched girders for each track, 2½ metres deep and spaced 2.03 metres apart, carrying the tracks on

The tuel used consists of briquettes, which produce very little smoke.

The trains consist only of second and third class carriages. There are no vans; and a guarantee against accident is granted only for one reserved compartment at the head of the train.

All of the trains are provided with a continuous compressed-air brake of the Carpenter system.

For the local traffic the trains are run during the week at ten minutes intervals in each direction from five o'clock in the morning to midnight. On Sundays and holidays they are run under five minutes headway. The minimum number of cars in a train is 8, the average weight II ½ tons.

The cars are compartment cars, and mounted on two axles 4.6 metres apart. The second class cars have four compartments; the third-class cars have five, each for ten persons. The running time of express trains making three stoppages only is from 34 to 37 minutes; at the terminals trains stop six minutes; the running time of locals between end stations is 45 minutes.

The stops at the stations average thirty seconds each; and the average speed of the local traffic is about fourteen miles per hour, including stops and slow running. A parcel post has not been established yet but is in contemplation. The trains are accompanied by a conductor only, who gives the signal for the departure of the train with a conductor's whistle. Only passengers provided with tickets are allowed to enter upon the platforms, where the tickets are punched by a guard. They must then be preserved by the passenger during the ride, and handed to

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a ticket-taker at the station at which the passenger leaves the train.

EXPANSES: RECEIPTS.

As we have already had occasion to state, it is the Prussian Government that constructed the Metropolitan Railway.

The figures given as the total first cost of construction are divided as follows:

Right of way, \$8,377,362; construction, \$9,482,868. Total expenses, \$17,870,230.

The actual annual expenses amount to about \$868,200. The receipts, deducting the traffic derived from the trunk lines, amount to \$772,000. It is therefore from the receipts of the trunk lines, all of which belong to the State, that the deficit of \$96,200, as well as the interest on the the capital sunk in the construction, must be made up.

Although the financial condition of the Metropolitan was crippled at the outset it is nevertheless improving. More could not be expected of a line which, at the time of its construction, and while the necessities of Berlin traffic required no such exploitation, presented only a strategic interest.

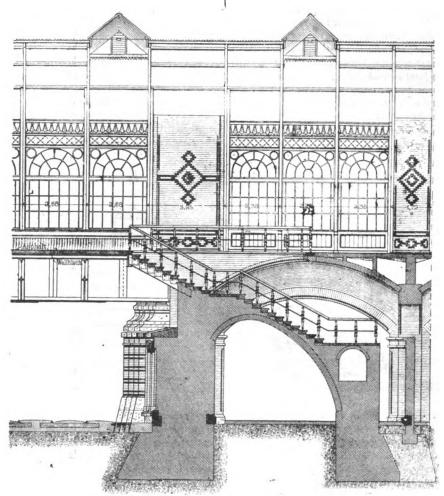
The construction of the railroad began in the fall of 1875, with the construction of some portions of the viaduct. Work, however, progressed slowly and had to stop entirely at intervals, on account of delays in acquiring the right of way, and because of the determination of the alignment, which in many essentials could not be concluded until the following year. At the close of 1877 only 917 metres of viaduct and the embankments and retaining walls at each end were completed and 950 additional yards of viaduct were in progress of construction. During this period of 21/4 years less than 47,000 cubic metres of masonry were completed. Construction was pushed, however, in 1878, when 2,800 lineal metres of viaduct were finished, and 1,200 additional metres were in progress of construction. Also the two masonry bridges were nearly completed, and the foundations for two depots were commenced. The amount of masonry put up in that year amounted to more than 102,000 cubic metres. In 1879, 1,100 metres of viaduct, with two stone bridges, the piers of the bridge over the canal and the basin, and of one of the Spree bridges were finished; also the superstructure of one of the stations. In 1880 the remaining portions of the viaduct and the foundations of nearly all of the remaining stations were commenced and nearly finished; and some of the iron-work was put up. The rest of the work, the finishing of the stations, the erection of the depots, the iron-work of the bridges and street crossings, the ballasting of the road-beds, and the finishing of all

superstructures were so nearly finished at the close of the year 1881, that the road could be opened for local traffic on February, 1882. During 1882 all work was finished; the road was opened for through traffic May 15, 1882. The cost of the whole road of a length of 12,145 metres, inclusive of the embankment approaches at each end, was 75,085,000 marks. Of this amount the cost of construction was 39,086,000 marks, and the cost of the right of way, 35,199,000 marks, leaving property on hand and not wanted, valued at 8,000,000 marks. Most of the construction work was done by contract.

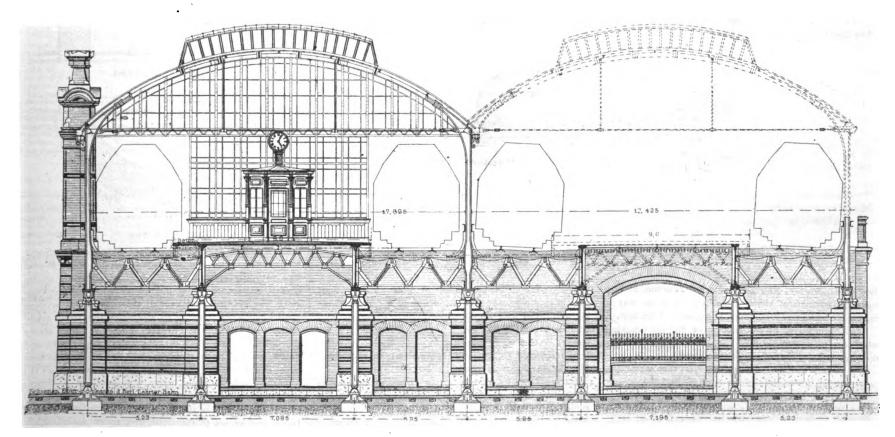
(To be continued.)

THE EIFFEL TOWER.

THE 1,000-foot tower in connection with the French Exhibition of 1889, and known by the name of the designer and constructor as Eisfel's tower, has now reached the height of 179 feet. The four arches of the base are now joined, and the great platform for the rooms of the first stage is about to be constructed, so that the work has passed the most laborious stage. Most of the construction will now proceed from the interior.— Engineer.



PARTIAL LONGITUDINAL SECTION, LEHRTER DEPOT.



CROSS SECTION, LEHRTER DEPOT.

SOME DETAILS OF WATER-WORKS CONSTRUCTION.

No. VII.

(Continued from page 88.)

BY WILLIAM R. BILLINGS, C. E., Superintendent of Water-Works, Taunton, Mass.

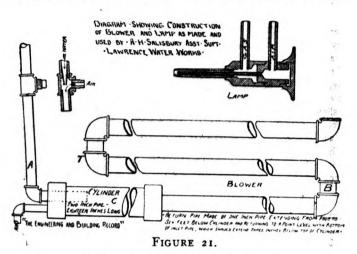
TAPPING.

The regulation wiped-joint is one of the awful mysteries of the plumber's craft, and a description of its making would avail but little. It is the plumber's shibboleth, and if one of the trade can be found who will admit that any other joint is its equal he may be counted as one out of many. It is not to be denied that in many instances nothing can equal in appearance and fitness a well-wiped joint, and a thorough workman certainly knows how to make one; but a well-made cup-joint is equally strong—perhaps stronger—does not require a tenth part of the solder, and is made more quickly and with less practice.

A cup-joint is shown in Fig. 20, and is made by expanding the end of the lead pipe with a properly shaped plug, scraping the inside of the cup with a jack-knife to give a

For heating Mr Brackett uses, or did use, a sweatingiron, and so did the writer until Mr. Ilenry W. Rogers, formerly Superintendent of the Lawrence Water-Works, introduced a blow pipe and air-pump apparatus which is a great improvement in speed and convenience over a pair of hot irons

The air-pump and the blow-pipe or lamp are shown in Fig. 21. A jet of water, whose size may vary with the pressure under which it is to be used and the work to be done, from 1/6-inch to 1/4-inch, induces a current of air to enter the tee, and water and air together enter the separating chamber C made of 2-inch brass or iron pipe. The water flows off through the trap or bent pipe to waste and the air through the smaller pipe to the lamp or blow-pipe. When the apparatus is in operation the outlet for the air is so small that air accumulates in the separating chamber and forces the water down below the top of the trap a distance depending on the special conditions which exist in any given case; and the pressure under which the air accumulates is measured by the difference between the heights of the two water-columns in C B and T B. The lamp is a Bunsen burner and the quantity of air from the pump, and of common gas from

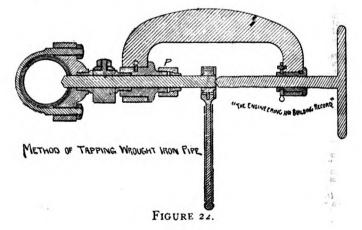


surface of clean metal, dropping a soldering nut or tailpiece, properly tinned, into the cup, heating the whole joint by some appropriate method, and finally by filling the thin annular space between the cup and the tinned brass casting with melted solder. If these details are properly executed a perfect joint is the result. The writer has had several of these joints sawn in two and the bond is then seen to be perfect.

This joint was brought to the writer's attention by Mr. Dexter Brackett, Assistant Engineer of the Boston Water-Works, and a study of the method and its results will show that this is not a "tinker's joint," for it is used in

a convenient jet, may be so regulated as to produce a flame hot enough to make a bit of chalk glow like a calcium light. In fact there is an excess of heat for joint-making, purposes and a little experience will be required to prevent one from getting the metals so hot as to cause the solder to run through.

A very convenient form to use the solder is that given by drawing the common sticks into wire, about ½-inch in diameter. Wire solder has been for sale at a high price, and a large consumer would find it cheaper to build a small mill and draw the wire for himself than to pay 25 cents per pound.



Boston, Lawrence, New Bedford, and Taunton by the water departments of those cities, who have no sort of reason for using any methods or materials but the best.

The only portions of the process of cup-joint making which call for special mention are the method of heating the joint and the kind of solder to be used.

We should note in passing, however, that while the plug is being driven to form the cup, the end of the lead pipe should be firmly held in a vise between two castiron half-round clamps that are cut out to correspond with the outside shape of the cup. When under these circumstances the plug is driven home, the lead forming the walls of the cup is compressed, and anything like a blister or defect has a chance of being closed.

There seem to be no standard weights for the various sizes of lead pipe, and an examination of a "Table showing weights of lead service-pipes used in various cities," which was compiled by Mr. William B. Sherman, of Providence, R. I., as an appendix to Mr. Richards' paper before referred to, will show more clearly than anything else the absence of uniformity.

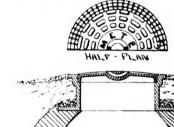
For any but excessive pressures, exceeding 150 pounds per square inch, the following weights will be found sufficient:

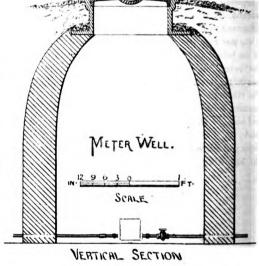
S'zeInches Weight per foot Pounds	1½ 3	5% 3%	34	1 4%	1½ 5½	11/2	
		<u>'</u>	!	<u>' </u>	1		

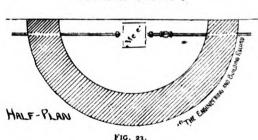
TAPPING WROUGHT-IRON MAINS.

There are more different methods of tapping cement-lined or coated wrought-iron pipe of any sort than of tapping cast-iron mains. Cast iron is seldom less than half an inch in thickness, but with wrought-iron the actual thickness of metal is one quarter of an inch or less, and it is evident that such different conditions call for different treatment. Figure 22 shows in section the apparatus used for tapping wrought-iron kalamein pipe, used by Mr. Frank E. Hall, Superintendent of the Quincy, Mass, Water Co., and to whom I am indebted for a drawing of the machine. A packing of sheet-lead is put between the clamp and the pipe at the point to be drilled, and if tightness is not secured by screwing the nuts down hard, the lead can be calked up.

With cement-lined pipe a similar clamp may be used. and such a clamp is a regular article of trade. A corporation cock may, however, be soldered or wiped directly on to the wrought-iron pipe without any clamp, and this is now the practice in many places. A small portion of the outside coating of cement is carefully broken away, the pipe is thoroughly cleaned and tinned, the cock is then attached to the main by soldering with an ordinary iron, or by wiping, and then with an arrangement similar to that shown in Fig. 22 a hole is drilled, passing the drill through the opened cock. After perforation the drill is withdrawn just far enough to allow the tapper to close the cock, and then the tapping apparatus is removed, the stuffing-box at P having kept the water back during the operation. Any convenient form of drill may be used, but Fig. 20 shows the form used at Plymouth, Mass.







SERVICE-BOXES.

Considerable ingenuity has been expended in efforts to devise a cheap and satisfactory service-box. Wood was, naturally enough, one of the first materials to be chosen, and scored at first an apparent success when the stock was kyanized, but even if the preserving process proved to be in some cases successful, the frost made stumbling-biocks of the boxes by throwing them above the sidewalk level. Combinations of drain pipe, light and heavy castings, and wrought-iron pipe with cast-iron bases might be described, but none of them, so far as the writer can judge, are any better, if as good as a simple cast-iron box in two principal parts sliding, telescope fashion, one insi le of the other. The extension shut off boxes, well known to the trade, give entire satisfaction, and at the price at which they are now offered it will hardly pay for any one to design a new pattern for any but special cases.

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METERS.

Of making many meters there has been no end, and much experience with with some of them is a weariness to the flesh. Of the six hundred or more that have been patented, six or less have come to any extensive use in this country, but in the value of that half dozen the writer has an abiding faith.

The important points in setting a meter are perfect protection against freezing, a firm support, accessibility, and in some cases protection against meddlesome fingers. Too much care cannot be exercised in the first of these points, for a frozen meter is worth its weight in junk only, as a rule, and meters have been known to freeze in cellars in which the potatoes (so the owner said) never froze. If a house is to be metered, and the cellar is without a furnace, the safest place for the meter is just below the cellar bottom, and if the ground is too wet to allow this, and draining the cellar is out of the question, then a tight double box, with a 2-inch air-space, affords the next best protection.

Even if a house is not to be metered, it often is wise to enter the service-pipe from the street below the cellar bottom, as this affords protection to the pipe and secures cooler water in summer. In some cases the only place for a meter is in a driveway, a sidewalk, or a lawn, and in such cases a brick wall with a cast-iron cover, the whole costing nearly \$25, offers the best arrangement, as shown in Fig. 23.

Meters should be well supported, either by a hanging shelf or a brick pier if one wishes to avoid all chance of springing the joints or the shell of a meter.

With lead pipe there is, of course, not the chance to hang the meter by the pipe that there is when iron or brass is used. It is quite important that a meter be so constructed as to have the inlet and outlet in the same line, for the best have to come out once in a while for repairs or cleaning, and then, with proper construction, a piece of pipe may take the place of the meter, with no inconvenience to the consumer.

ELECTRICITY FOR STREET-RAILWAYS.*

W. H. PREECE, F. R. S.

THERE are few people who know that the number of horses required to work a tramway is 12 per car. My figures are taken from Manchester, where there is one of the best-worked systems of tramways that we have in this country. There every car requires 12 horses to work it; the life of a car horse on those tramways is only four years. Working tramways in the north, wherever there are heavy gradients, is really cruelty to animals. We know that a horse can only do a horse's work; there are some men who can do a good deal more than an ordinary man's work, but we rarely should expect any man to do more than five or six men's work. But these tramway horses are absolutely frequently called upon to do-eight or ten times more than nature has constructed them to do, and it is no wonder that their life is so very short. This remarkable fact comes out in dealing with horses from a pure matter-of-fact point of view. If we work a tram-car by electricity by means of batteries placed in the car, taking the price of horseflesh and the price of batteries per ton, the cost is exactly the same—it requires a ton-and-a-half of horseflesh, it requires a ton and-a-half of batteries to work a car. The life, as I stated, of a car horse is four years; the life of a battery is four years. A horse will hardly do more than thirty miles a day; a battery will carry a car for sixty miles a day, and, in fact, when we remember that for the price of two horses, for the life of two horses, we can work tramcars by means of electricity, then when you think that it takes twelve horses, the mere question of £ s. d. will carry the day. There is not the slightest doubt that, when the matter is properly and thoroughly worked out in a practical manner, batteries can and will work tramways, and the day is not far distant when all our tramways in and about London will be worked by means of batteries, and the poor horses relegated to duties for which they are

TABLE OF STREET RAILWAYS OPERATED BY ELECTRICITY.

Taken from the Electrician and Electrical Engineer.*

Electric Tramways in America.

Town.	LINE.	Conductors.	Length, miles.	System.	Power.
Asbury Park, N. J	Appleton Electric Street Ry	••	43/2	Van Depoele, 5 motor cars. Daft.	
Relievne Fa	Union Passenger Ry, Company,		5½ 5½	Van Depoele,	
Denver, Col	Denver Tramway Company Detro t Electric Ry. Company	Conduit. Overhead.	4	Short-Nesmith Series. Van Depoele, 4 motors cars.	
Gratiot, Mich	Highland Park Wy. Company	"	3	motor cal.	
Kansas City, Mo Lima, O	Kansas City Electric Ry, Company	Overhead.	61/2	Lenry. Van Depoele, 7 motor cars.	
Mansfield, O	Los Angeles Electric Ry, Company Capital City Electric Street Ry, Company	 		Dait, 4 motor cars. Dait. Van Depoele, 20 motor cars.	
Port Huron, Mich	Port Huron Electric Ry. Company	"	21/4	Sprague motors	
cranton, Pa	Scranton Suburban Ry. Company		6 21/4	Van Depoele. Van Depoele, 3 motor cars.	
Windsor, Can	Wichita Riverside and Suburban Ry. Co Windsor and Walkerville Electric Ry. Co Woonsocket Street Ry. Company	** **	11/4		

On the Continent.

Amsterdam	Overhead. Rails. Nil. Overhead.		Siemens. Accumulators (Julien). Siemens,	Steam
Cologne	Nil, Overhe ad. Nil.	4.1	(Huber). Siemens.	team
Hohenzollern	Overhead.	1/2 2.8 1/2	(Huber). Siemeus.	Steam

In Great Britain.

	1	ı	1	7
Blackpool Blackpool Tramway	Buried central rail.	2	Holroyd Smith.	Steam.
Bright n Brighton Beach	Rails.	1	Volk.	Gas.
Brighton Beach Brighton and Shoreham Tramway	Nil.	4	Electric Traction Syndicate (Accumulators.)	Steam.
Glynde Glynde Clay Pits	Open.	1	Telpherage.	j "
Manor-park)		4	Elieson (Accumulators.)	**
Newry Bessbrook and Newry	Raised central rail.	31/4	Hopkinson.	Water.
Portrush Portrush and Bushmills	Raised side rail.	6	Sicmers.	••
Ryd-, 1, WRyde Pier	. Rails.	34	Sirmens.	Gas.

^{*} From a lecture on "the Application of Electricity to Lighting and Working," published in the Journal of the Society of Arts.

THE FLOW OF AIR IN PIPE-SEWERS AND ITS EFFCT ON TRAPS AT THE FOOT OF SOIL-PIPES.

WE have received a copy of the printed evidence submitted in the case of the Drainage Construction Company vs. the city of Chelsea, Mass., in the Circuit Court of the United States in Equity. The Drainage Construction Company is practically Colonel George E. Waring, and the suit is to prevent the city from using automatic flushtanks in connection with a system of pipe-sewers. The city purchased some Field flush-tanks, and the question at issue is its liability for royalty in using them in connection with a system of sewers alleged to infringe a patent of Colonel Waring's. The suit is not yet concluded, but the following testimony of William E. McClintock, the Engineer of the city, in which he gives an account of the observations made by him on the system of sewers, is of interest, aside from the merits of the suit. He found that there was an almost constant current of air through the sewers varying from one to four feet per second. Generally, the air-current is opposed in direction to that of the watercurrent, though there is a constant but very slight flow of the air just at the surface of the water in the same direction with the water. The discharge of a flush-tank causes the air to flow down the sewer with a velocity of from two to four feet per second for from 35 to 100 seconds. The effect of the flush on the air is lost in about 300 feet of

Mr. McClintock savs:

"I have made a series of experiments dated December 6, 1886, as follows, to show the action on the water in a trap attached to a 4-inch pipe branching into a 6-inch pipe, with a current of air through the larger pipe.

"The apparatus consisted of a length of 6-inch tin pipe about 28 inches long; from this led a 4-inch pipe, with an offset in it, making a water-seal one and a half inches deep. A slot cut through the side of the trap, covered with glass, having a scale measuring sixteenth of an inch marked on its surface, enabled observations to be made on the surface of the water in the trap.

"The observations were made at the Magee Furnace Company's foundry, using the furnace-blast for getting a movement of the air.

"The apparatus used consisted of two pipes and a trap, as above described; this was connected with the air-blast by means of a 4-inch pipe tapped into a cap on the main blast-pipe, enlarging to a 6-inch pipe; in the supply was a slide to regulate the amount of air furnished to the 6-inch pipe.

"First—The trap was filled with water; a full blast was then turned on equal to 33½ feet per second. The effect of this blast was only felt in the tremor of pipes and slight spilling of the water.

"There was a lowering of the surface of trap water of about one-sixteenth inch on the side away from the large pipe.

pipe.
"The velocity of the air through the pipe was varied to

First 8½	feet	per second.
Second	**	44
Third 141/2	**	"
Fourth	• •	**
Fifth 221	**	
Sixth 25	**	••
Seventh 2735	**	••

" During the above trials no change was observed in the surface of the trap-water.

"Second—The water was removed from the trap, leaving a clear opening through the pipe. Trials were next made to ascertain if the flow of air through the 6-inch pipe induced a flow through the 4-inch pipe.

"Velocity taken at the end of the 6-inch pipe and at the outer end of trap-pipe with the same velocity, in 6-inch pipe at each observation:

(a)	Velocity at	end of	6-inch	pip	e 1.6 f	ect p	er secon
, ,	**	**	4	••	0.0	44	**
(8)	**	• •	6	**	3.2	**	• •
•	44	• •	4	**		"	44
(c)	44	**	6	• •	4.1	**	**
• • •	4.	**	4	••		**	• •
(d)	46	**	6	**	5.7	••	4.
, .	**	**	4	**	2.6	**	4.
(e)	• •	**	6	••	7.7	4.	44
•	**	**	4	**	2.8	**	44
(7)	••	44	6	**	12.2	••	**
(5)	••		4	••	4.5	**	• •

"It will be seen by the above that there is no induced current of air in the trap-pipe until the velocity in the 6-inch pipe reaches between 4 I feet per second and 5.7 feet per second, then the sir passes through the trap-pipe

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with a velocity about one-third to one-half as fast as the air in the 6-inch pipe.

"These experiments were not made upon the sewer itself, but upon an apparatus constructed for the purpose.

"Int. 99. Did you make any experiments with the same apparatus to show the effect of the pressure of a current of air moving through the pipe representing the sewer, in forcing the water out of the trap? If so, will you produce the record of such experiments as a part of this answer?

"Ans. I made experiments, of which the following is

"DECEMBER 11, 1886.

"Experiments at Magee's Foundry, Chelsea, to determine the action of the pressure of air moving at different velocities on a body of water in a 4-inch trap, such as is used in the Prattville sewers:

"The apparatus used for the trial consists of a piece of 6-inch pipe; leading out of this is a 4-inch pipe with a trap having a water-seal of 13/4 inches. This is placed in such a position as to receive the air from the blast-pipe of fan, the same being regulated by a slide so as to give different velocities through the pipe.

"The end of the 6-inch pipe was placed 14 inches from the end of the blast-pipe, making a break in the pipe of 14 inches, which is three inches in diameter, enlarging to six inches.

"A slot in the side of the trap, in which was set a piece of glass, enabled the surface of the trap-water to be observed.

"The air was first allowed to pass through the 6-inch pipe, the velocity being measured by meter; the cap was then placed over the end of the 6-inch pipe, the air being pressed back on the surface of the trap water by its own velocity alone; the height of the trap water was then observed, the difference between the reading before and after the cap was put on being caused by the action of the air and varying with the velocity of the air.

"The following table gives the results of the above trials.

"The results are an approximate of the true results, and are close enough to judge what the effect of a current of air flowing through a sewer will have on the water in a trap. The trap is full when the reading on the side gauge is 20; the divisions on gauge are sixteenths of an inch.

Table showing the effect of pressure of air at different velocities on the water in a trap:

/elocity	pipe.		inen Column	Column of water supported oy air.					
2.55 fe	et per	secon	db sis	teenths	of inch.				
3.30	**	**	r	**	**				
3.58	**	••	I	**					
4.58	**	••	2	••	**				
8 17	••	••	5	"	••				
10.50	**	**	6	**	••				
10.92	••	••	6	**	**				
11.25	**	**		**	. **				
12.33	••	••	2	•• .	••				
15.00	••	••	4	**	••				
28.33	••	••	18	"	••				
29.17	**	44	20	**	+1				
33.17	**	• •	22	••	**				
Full bla	ast		28	**	**				

"In the above observations there is a chance for a slight discrepancy, owing to a variation in the velocity of the air between the time of placing the cap over the 6-inch pipe and the reading of gauge on trap.

"This would account for the small readings opposite the 8th, 9th, and 10th readings. A series of readings would give a mean value that would eliminate the apparent error."

BENEFIT CONFERRED BY RIVER AND HARBOR WORK

THE advantages following the improvement of waterways in the State of North Carolina are set forth by Capt. W. H. Bixby, Corps of Engineers, U. S. Army, in a recent letter to the Wilmington *Messenger*, from which we quote:

"Few people realize the advantageous commercial, agricultural, and colonizing effects produced by the Governmental improvement of rivers and harbors of the United States, and especially of the South Atlantic and Gulf States

"The rivers and creeks of the South Atlantic and Gulf States are, as a rule, streams of gentle slope, considerable

length, and moderate depth, obstructed mainly by sunken logs, snags, and fallen or overhanging trees. Were these latter obstructions thoroughly removed (usually readily done at a comparatively small cost) these rivers and creeks would at once appear in their new role of natural and economical navigable waterways, similar to and rivaling the artificial and more expensive canals of the Northen and Middle States. As soon as one of these streams is opened to commerce, the reduction in freight charges is so considerable as to encourage the rapid development of such towns as are already in existence along its length: and the certainty and cheapness of its freighting and traveling facilities authorize the establishment of continuous and extended settlements all along its banks over large areas of good land, until then so deprived of transportation facilities that the sale of farm products would not even pay the expenses of their transport to the nearest market. More than this, the removal of obstructions from the bed and banks of the stream facilitates the free movement of water in the stream and aids so greatly the natural drainage of the river bottoms and other adjacent lands, that land until then malarious and sickly becomes fit for habitation and culture.

"In this way we readily see that the Governmental improvement of such rivers and harbors not only increases the existing commerce of such waterways, but improves the drainage, culture, value, and health of the adjacent lands, builds up the existing towns, and encourages the settlement of previously unoccupied territories. In no other way can so small an expenditure of public money produce such valuable results in the development of the country at large.

"As an example of this good work let us look at the results obtained in the States of North and South Carolina during the last few years preceding the 1st of July, 1887.

"On the Trent River, N. C, since 1879, about \$42,000 has been spent in opening up about forty miles of river, reducing freights by from 25 to 75 per cent., rendering marine insurance unnecessary, and increasing the commerce by \$250,000 per year, thus showing a development of \$6 of annual commerce for each dollar once spent by the Government.

"Oh the Contentnea Creek, North Carolina, since 1881, about \$34,000 has been spent in opening up about thirty miles of river, reducing freights by from 12 to 50 per cent. and building up a commerce of \$600,000 per year, thus showing a development of \$17 of annual commerce for each dollar once spent by the Government. Besides this, two towns on the creek bank have nearly doubled in population and property, and the whole river basin shows marked gains in settlement and prosperity.

"On the Pamlico and Tar Rivers, North Carolina, since 1876, about \$56,000 has been spent in opening up about sixty miles of river, reducing freights by from 12 to 25 per cent. and increasing the commerce by \$1,800,000 per year, thus showing a development of \$32 of annual commerce for each dollar once spent by the Government. Besides this, the town of Washington, N. C., has increased 25 per cent. in population and property, and the town of Greenville has increased from 912 population and \$266,000 real estate in 1880 up to 2,505 population and \$600,000 real estate in 1886, the development of both these places since 1876 being almost entirely due to the river improvements.

"On the Neuse River, N. C., since 1878, about \$220,000 has been spent in opening up about 70 miles of river, reducing freights by from 25 to 75 per cent. (the freight on cotton being 75 cents per bale, where it was formerly \$2.75 per bale by wagon and rail), rendering marine insurance unnecessary, and increasing the commerce by \$1,800,000 per year, thus showing a development of \$8 of annual commerce for each dollar once spent by the Government. Besides this, the whole river basin is rapidly gaining in population and prosperity.

"On the inland waterway from Newbern to Beaufort, N. C., at Beaufort Harbor, N. C., on the inland waterway from Beaufort Harbor, N. C., to New River, N. C., at New River, N. C., and on Black River, N. C., the present unfinished improvements will give returns at least equal to (if not exceeding) those of the preceding waterways.

"On the Cape Fear River, N. C., at and below Wilmington, since 1829 about \$1,800,000 has been spent upon the improvement of 26 miles of river, increasing the available draft 7½ feet in 1829 up to 16 feet in 1886, reducing greatly marine freights and insurance, and increasing the foreign commerce by \$4,500,000 per year since 1871, thus

showing a development of \$2.40 of annual foreign exports for each dollar once spent by the Government during the same period; although the last increase of two feet in draught in the river channel is too recent to produce its natural effect on such development. The present development of the lower Cape Fear River means the future development of all the State of North Carolina and of many Western States which will before long be forced to send their commerce by new and shorter routes via North Carolina railroads and the Cape Fear River to the ocean and foreign markets.

"On the Cape Fear River, N. C., above Wilmington, since 1881, about \$66,000 has been spent in opening up 112 miles of river, abolishing former tolls, reducing freights by about 33 per cent., rendering marine insurance unnecessary, and increasing the commerce by \$1,200,000 per year, thus showing a development of \$18 of annual commerce for each dollar once spent by the Government.

"On the Waccamaw River, S. C., since 1880, about \$45,000 has been spent in opening up about 70 miles of river, reducing freight, rendering marine insurance unneccessary, and increasing the commerce by \$1,200,000 per year, thus showing a development of \$26 of annual commerce for each dollar once spent by the Government.

"On the Great Pee Dee River, S. C., since 1880, about \$37,000 has been spent in opening up about 200 miles of river, reducing freights by from 25 to 60 per cent. (the freight on cotton being now by river 75 cents, where it was formerly \$1.75 by wagon and rail), and increasing the commerce by \$1,6 ×0,000 per year, thus showing a development of \$43 of annual commerce for each dollar once spent by the Government. Besides this, the neighborhood of the river is steadily developing under the influence of better transportation facilities.

"At Lockwood's Folly Inlet, N. C., on Lumber River, N. C., Little Pee Dee River, S. C., Clark's Creek, S. C., Black Mingo River, S. C., Alligator Creek, S. C., streams already recommended for improvement by the Government; and at Georgetown Harbor, Winyah Bay, Santee River outlet to Winyah Bay through Mosquito Creek, waterways already under improvement by the Government, the present indications are that the completion of the present recommended improvements will give returns at least equal (if not superior) to those of the preceding named waterways. The speedy improvement of Winyah Bay means a rapid increase in the development of the Santee and Pee Dee River basins comprising two-thirds of the entire State of South Carolina; and a single immediate outlay of \$800,000 properly spent here would undoubtedly quickly develop an additional South Carolina commerce of \$8,000,000 per

"On the Wateree River, S. C., since 1882, about \$33,000 has been spent in opening up 64 miles of river. Nothing but the obstructions offered by the S. C. R. R. and the W. C. & A. R. B. bridges (mainly the S. C. R. bridge) now deprive the adjacent fertile lands of Kershaw and Richland Counties from the free transportation facilities to which they are justly entitled; and nothing but the obstruction offered by these bridges now prevents a development of river commerce (similar to that of the similarly situated Great Pee Dee River), which will probably amount at once to from \$500,000 to \$1,000,000 per year.

*On the Congaree River, S. C., since 1861, about \$5,000 has been spent in fairly opening up 47 miles of river. Nothing but the obstructions offered by the S. C. R. R. bridge now deprives the city of Columbia, S. C., and adjacent river valley of a free water communication with the ocean ports of Georgetown and Charleston; and nothing but the obstructions offered by this bridge now prevents a development of river commerce (similar to that of the similarly situated Great Pee Dee River); which will amount at once to from \$1,000,000 to \$2,000,000.

"Although the above improvements have already produced such good results in the development of the country, these improvements are to-day not more than half completed; and there is every indication that further improvements will be accompanied by equally good results until the cost of such improvement shall amount to fully double what has been already spent by the general Government."

A CONCESSION has been granted by the Honduras Government for a railroad from Puerto Cortez, on the Atlantic coast, to Amapala on the Pacific coast. The distance is three hundred miles. A line had been surveyed several years ago, but was abandoned. The route was found quite practicable.



MISSISSIPPI RIVER WATER.

THE report of Dr. Charles Smart, U. S. A., giving the results of a series of analyses made for the State Board of Health of Minnesota of waters from the Mississippi River and some of its tributaries, has been published by the board. The following extracts from it will be found of

In examining the waters of the upper Mississippi, singular and unlooked-for results were obtained by the process for determining the amount of oxygen required to oxidize the dissolved organic matter. These will be of much interest to those engaged in the study of natural surfacewater, showing, as they do, in waters that are free from sewage, factory refuse, or other matters usually considered to be of dangerous quality, an amount of oxidizable organic matter such as would warrant an unhesitating condemnation of the water for domestic use. The rule condemnation of the water for domestic use. The rule which experience has hitherto educed may be expressed as follows: Well-waters which require .2 parts of oxygen per 100,000 of the water are usually dangerously charged with the products of animal waste; but a surface-water which has no manifest sewage inflow may decolorize the equivalent of .4 parts of oxygen without being considered as of doubtful quality. The organic matter of surfacewaters is of a carbonaceous or vegetable nature, and is derived from decaying vegetation found on the water-shed. This is generally regarded as harmless; but when the amount of oxygen required exceeds 4, the water yielding this result approximates in character to that of swamps and marshes, and must be viewed with proportionate sus-picion, or it is connected with some source of contaminapicion, or it is connected with some source of contamina-tion which should be discovered and shown to be of a harmless nature before t e water is warranted as whole-some in this respect. The water of the Mississippi River at Aitkin, Brainerd, and St. Cloud contained an amount of vegetable organic matter largely in excess of that regarded as coming within the limits of wholesomeness in a surface-water; Aitkin waters required 1.204 of oxygen; Brainerd, 1.082 St. Cloud, 1.122. The water from a

Brainerd, 1.083; St. Cloud, 1.132. The water from a Louisiana swamp required 1.254.

The vegetable character of the organic matter in question was indicated by the relatively small amount of nitrogen evolved from it as ammonia; a dilution of sewage nitrogen evolved from it as ammonia; a dilution of sewage or other foul liquids of animal derivation that required this quantity of oxygen would have been rankly ammoniacal or putrefactive in its odor. The vegetable matter in a swamp-water is decomposed more readily, and yields a proportionately larger quantity of albuminoi ammonia than was obtained from the water of the upper Mississippi. Moreover, this vegetable matter was of a stable or nonputrescible nature as shown by the slow manner in which the albuminoid ammonia was evolved from it during

the Wanklyn process.

Previous laboratory work had obtained results of this kind from such substances as Irish peat, and pine shavings or sawdust. It is not unlikely, therefore, that the large quantity of permanganate required for the oxidation of the organic matter in these waters indicates no unwholesome constituent, but a carbonaceous and probably resinous contribution from the timbered lands of the watershed. The St. Croix River contains a similar vegetable product which, although in smaller proportion than in the Mississippi, is nevertheless sufficient to raise doubts concerning the quality of the water, unless the harmlessness of its nature be demonstrated. The Minnesota River contains considerably less vegetable matter than the St. Croix, although more than is commonly found in Eastern rivers having a naturally clean water-shed. Evidently the Minnesota drains a country that is comparatively barren of the vegetation which so strongly charges the waters of the Mississippi and St. Croix.

Running water is generally credited with the ability to purity itself, and, indeed, it is certain that much of the dissolved matter of sewage is readily destroyed by the agencies operating on it during its flow. Urea, for instance, is speedily decomposed into ammonia, which, with the ammoniacal products of putrefaction, is as speedily decomposed and ammonia products of putrefaction, is as speedily decomposed and ammonia products of putrefaction, is as speedily decomposed and ammonia products of putrefaction, is as speedily decomposed and ammonia products of putrefaction, is as speedily decomposed and ammonia products of putrefaction and products of putrefaction. with the ammoniacal products of putrefaction, is as speedily converted into nitric acid. But it seems probable that dilution has as much, if not more, to do with the disappearance of the sewage of Minneapolis and St. Paul in the Mississippi River than the chemico-vital processes. The nitric acid in fifteen samples of river-water, collected at various points above the inflow of sewage at Minneapolis, averaged .0113 per 100,000 of the water; in eight samples collected below Minneapolis, and at and immediately below St. Paul, the average quantity was .020; in nine samples from Red Wing and Winona, the average was .0110. Nitric acid is a stable compound and does not disappear from its solution as do ammonia and organic nitrogen. The reduction in its quantity at Red Wing and Winona to the average contained in the waters above Minneapolis, notwithstanding the polluted inflow at that city and St. Paul, must therefore be attributed wholly to the immensity of the dilution. the immensity of the dilution.

The same thing is shown by the chlorine estimations. Sixteen samples taken from above the inflow of the Minneapolis sewers gave an average of .168 per 100,000 of the water; nine samples from Minneapolis and St. Paul water; nine samples from Minneapolis and St. Paul yielded an average of .425, and ten samples from the river at Red Wing and Winona gave .246. The decrease by dilution is at first sight less in this case than in that of the nitrates; but when it is remembered that the Minnesota River contributes to the Mississippi, between Minneapolis and St. Paul, a large quantity of chlorine without a relatively corresponding quantity of nitrates, the persistence

ANALYTICAL RECORD OF CERTAIN WATERS

Examined in the Laboratory of the State Board of Health of Minnesota during November and December, 1886. (Results are expressed in parts per 100,000 of the water.)

	Total solids.	Loss on ignit on.	Nitrites.	Nitrates.	Chlorine	Oxygen required.	Free Ammonia.	Albuminoid Ammonia.	Remarks.
Waters from Aithin, Minn. Mississippi River above city	19.c 40.o		nore. none. none.	.c15 .c23 .037	.21 .21 .21 3.40	1.204 1.160 1.228	.005 .006 .026	.044 .027+4 .022+4 .008	Water clear and almost colorless; car- bon in residue diss pated with difficulty but with little odor. Clear and colorless; faint darkening or ignition.
Waters from Brainerd, Minn. Mississippi River below city	15.0	6.5	none.	.0074	. 17	1.083	.003	·037+4	Clear; carbon dissipated with difficulty.
Waters from St. Cloud, Minn. Creek above water-works Mississippi River, tap in water-works household tap below city Waters from Stillwater, Minn.	24.0	3.5	.005		1.20 .15 .20	.900 1.132 .868 1.224	.004 .022 .0105 .027	.034+4 .0255 .017+4 .026	C'ouded and with much sediment. Clear and colorless.
St. Croix River 1/2 mile above city	16.0 21.0 41.0 19.5	1.0	trace. none. trace. none. present.	.004 .019 .004 .005 .005 present. trace.	.15 .14 .10 .20 .10 6.20	.604 741 .750 .317 .135 .341 .097	.0025 .0055 .005 .002 .012 .035 .038	. o o5+3	Yellowish but clear. Clear; faintly yellow. Clear and col rless. Faintly yellow; clear. C'ear and colorless.
Mississippi River, a miles above city description above water-works tap in household tap below flats	21.0	5.0	none. none. none. trace. present.	.030 .0074 .01 .0046 .013 .0046 .013	.16 6 .13 .2; .13 .14 .13 .17	.731 .775 .914 .794 .687 .643 .730 .720 .717 .848	.0185 .020 .000 .0615	.0135 .023 .014+4 .026 .014+4 .010+4 .010+4 .026+4	Clear, but somewhat yellow tinged; no mark, d taste or odor. Clear; faint darkening on ignition
Well, unknown Ice from Cedar Luke "Mississippi River Waters from Mankato, Minn.	148.0	42.6	trace.	present.	.19		.076 .025 .015	.025	atrous odors.
Blue Farth River	45.0 45.0	6.0 5.0	trace.		.20 .25 .34 .80	.312 .480 .375 .609	.014 .024 .059	.017 .023 .035+5	Clear and colorless.
Waters from Fort Snelling, Minn. Mississippi River			trace. trace.	.010	.16 1.18	.877 .327		.033 .020+4	Clear; yellowish.
Mississippi River at city	17.5 30.0	2.0 6.c	noneoz none. trace.	.010 .026	.45 .58	.714 •77° •750 1.028	.044 .102 .0035	.060	Yellow, but clear. Somewhat yellow and with a dark colored flocculent sediment. Yellow, but clear. Faintly yellow, with a dark-colore flocculent sediment.
Lake Phalen		5.5	present trace. trace. none.	.036 .•30	.45 .66	.773 1.c02	.026 .^41 .002 .033	.052+4 .c06+3 .c12+3	Yellow, but clear. Family yellow, with a sediment of dark colored flocculi. Clear and colorless
Ice, Mississippi, at city below city level at city lece, Lake Phalen Como			trace. trace. present. none. trace.	.016	.25 .13	.687 .687 .302 .117	.074	.009 .084 .028+5 017	Nearly colorless; a sediment of gray (ish floccul.) Clear. colorless; a whitish pulverulen sediment. Colorless, but somewhat clouded; a flot culent sediment.
Waters from Red Wing, Minn. Mississippi River, bay above city opposite city at intake of water-works. at water-works tap water-works Well, artesian, at railroad station	17.5	3.0 3.5 5.5 10.0	none.	.014 .013 .012	.30 .20 .27 .27 .30 8.60	.816 1 024 .807 .816 .778 .528	.0125 .007 .013 .002		-Vellow, clear; no odor; alluvial taste. Brownish, clear; alluvial and ferruginous taste; sediment reddish froi iron. Faintly clouded white and with sul
Well, 'Scandinavian''. Cistern, private residence	38.0	10.0		2.042 present.	3.60 .22 .12	.029 .300 .220	.087	.0015 .008 .008+4	phureted taste and odor. Transparent and colorless; no tast nor odor.
Waters fron Winona, Minn. Mississippi River above city opposite city below city Lake Winona		5.0	none. trace. none. none.	.0074 .0074 .01 .0074 .017	.22 .22 .25 .22 .21	.897 .868 .777 1.102 .809	.014 .0025 .001	.0155+4 .018+4 .034 .0185 .052	Yellowish, but clear
Well, general supply. "Windom's. Fourth Ward. "Wilson & Sarnia. "Park House.	32.0 25.0 8.5	3.0	present.	present. .565 present.	2 CO 1.60 .40	.120		.006 .001 .0015 .001	Clear and colorless.
Waters from Rochester, Minn. Well, unknown	20.0	6.0			.25	.000	.002	.001	

of a larger proportionate amount of the former at Winona

may be easily understood.

This dilution is also indicated by the decrease in the I his dilution is also indicated by the decrease in the quantity of the carbonaceous vegetable matter as the stream is followed down from Aitkin. The amount of oxygen required for the destruction of organic matter is decidedly less at Winona and Red Wing than at the upper settlements, notwithstanding the output of oxidizable substances by the two large intervening cities.

Three specimens of ice from the river at St. Paul were found unfit for use, two of them being, in fact, solidified

sewage, showing but few signs of having undergone the certain amount of purification which usually results from a gradual congealation. The specimen of Lake Como ice was decidedly inferior to that from Lake Phalen, although the latter appeared to have met with some accidental contamination, as it was less pure than the waters of the lake. Ice from Cedar Lake was less satisfactory in its character than that cut from the Mississippi at Minneapolis. The host specimen of river-ice examined was taken from near than that cut from the stage of the Red Wing Water-Works. The chemical characters of ice are related to those of the water from

Digitized by GOGI

which it is formed. The worst specimen of a series of Syracuse ice samples recently examined by Dr. Willis J. Tucker yielded only .005 of free ammonia, and .001 of albuminoid ammonia in 100,000 parts of the water, and required only .04 of oxygen for the destruction of its organic matter. But the Red Wing sample may be accepted as a fair specimen of Mississippi River ice, the slow evolution of its albuminoid ammonia being held in remembrance.

The well-water from Aitkin does not give good results; it contains an excess of chlorine, and the free ammonia and nitrates indicate the proximity of the well to the source whence the chlorine was derived.

ANNUAL REPORT OF THE POUGHKEEPSIE WATER COMMISSIONERS.

WE give below an abstract of the nineteenth annual report of the Poughkeepsie Water Commissioners to the Common Council for the year ending December 31, 1887:

"The consumption for the whole year was somewhat in excess of last year, though the increase was in a less ratio than the increase of services. The volume pumped is, however, far too great for the need of the city, taking as a basis of estimate the quantity used by the metered services, which now comprises nearly one-third of all the services in use.

"In the early part of the year an amendment to the rates was adopted, requiring all new services to be metered. Accordingly all the services added this year are metered services. This change has seemed to meet with general approval, and more services have been added than in the year previous.

"In the report of last year reference was made to the desirability of placing meters upon the services of all the city buildings, in order to locate and check the waste therein, and it is hoped that your honorable body will give its early attention to this matter. In view of the fact that more than 640,000,000 gallons of water have been pumped during the year, and that nearly one-third of the consumers—those under the meter system—have used less than 69,000,000 gallons, this board is of the opinion that it would be a wise expenditure to apply a portion of the surplus of the receipts to the purchase of meters, to be placed on the old services, in order that as soon as possible the entire city may be brought under that system and all classes of consumers placed on the same basis.

"The meter rates have been reduced from time to time during the past eight years, and it is the purpose to continue such reduction as rapidly as the increasing revenue will permit.

"The sewer system has been in good working condition. At the request of the Board of Health, the outlet of the Fallkill main sewers has been trapped to prevent the escape of the odor into the atmosphere.

SUPERINTENDENT'S REPORT.

"Referring to the filter-beds, the Superintendent says:
"During the months of August, September, October, and part of November there was an unprecedented development of low plant life of the order of filamentous algæ, family oscilla toriaceæ. This development would begin in minute patches on the surface of the sand as soon as the beds were cleaned, and in a few days would cover the surface like a blanket, and a few days later no water would pass through the beds unless this blanket was removed. It was necessary to clean the beds twice in each of the months mentioned, and during the year they have been cleaned sixteen times."

"The cost of removing ice, cleaning beds, and washing sand during the year has been \$795.42; gallons of water filtered, 644.858,352; cost of filtration per million gallons. \$1.23.

"One hundred and eight new meters were bought during the year at a cost of \$1,608.75, and \$101.90 was paid for repairs.

"The volume of water pumped during the year was 644.858,352 gallons.

"It is a singular fact that while the total volume is about ten millions in excess of that in 1886, and while the winter was of unusual severity, the volume pumped in the three coldest months January, February, and March, was about ten millions less than in the corresponding months of 1886. Also that the excess of consumption this year has occurred in months, July. August, September, and November, in which, by reason of abundant rainfall and absence of frost, the least consumption was to be expected.

pected.
"The volume that passed through the 530 metered services was 68,800,000 gallons, and of this quantity 33,290,000 passed through 40 meters. Applying this ratio to the

whole number of services would give less than 230 million gallons for the annual necessary consumption. This volume constituted the paying volume from which revenue is derived. The whole volume pumped cost per 1,000 gallons about three cents.

"The water delivered to the city throughout the year has been of excellent quality, except for a period of ten days in April and about two weeks in December, when a clayey sediment was present, producing a discoloration that sand filtration alone will not remove.

"Notwitstanding the unusual development of algæ at the filter-beds referred to, there has been no unpleasant odor or taste in filtered water. There has been but slight indication of the presence of sea-water.

indication of the presence of sea-water.

"The water-pipe system comprises 18 miles of cast-iron pipe, from 4 to 24 inches diameter. The cost of maintaining the water-works for the year was \$18,011.44, and for the sewers, \$2,289.80. Cost of pumping 644,858.352 gallons 280 feet high, \$10,287.32; cost of pumping 1,000,000 gallons one foot high, 5.7 cents, and for filtration per 1,000,000 gallons, 0.44 cent. Cost of water per million gallons at tap, \$27.90."

PRESSURE DOES NOT ASSIST HOT WATER CIRCULATION.

NEW YORK, December 10, 1887.

SIR: In looking over a catalogue of hot-water heating apparatus I find that the maker of the apparatus considers that pressure will increase the circulation of the water within the pipes. He seems to class apparatus under two heads—namely, gravity hot-water apparatus, or ones that are open to atmosphere, and pressure apparatus, or ones that are closed similar to a car-heating apparatus. Will you kindly explain through the columns of your journal what the difference is, if any, and help a novice out?

Yours truly, B.

[It is wrong to suppose that any pressure in excess of the water column in the apparatus will increase the velocity of flow of water through the pipes, all other things being the same. There seems to be an idea that a car-heating apparatus has a closed tank for this purpose, but this is erroneous. The use of a closed tank is twofold in a car: It prevents loss by evaporation or slopping, and it permits of getting a greater pressure in the pipes, and consequently allows of warming the water above 212°, which cannot be done with an open apparatus without making steam. Below 212°, however, the apparatus, whether open or closed, will give the same result in velocity of flow. Above 212° there may be a greater velocity of flow, due to a greater difference of temperature and consequent density of the water in the up and down legs of the apparatus. If the maker of the apparatus explained that by closing an apparatus he could get a greater temperature (with its attendant and unavoidable greater pressure) and thereby increase the velocity of flow by a greater difference in temperature between the up pipes and the down pipes, then he would not have misled you and many others.

A great many in the trade, however, really think a closed apparatus circulates better than an open one. Under similar temperatures, however, there is no difference, and to increase the temperatures above 212° Fah., it matters nothing whether you do so by lifting your tank high up or by compressing air above the water in a low tank. In cars the former is not practicable, however, and if it was there would be no bursting of hot-water apparatus in railroad cars.]

"A CONSTANT READER," Grand Rapids, is informed that anonymous communications are not answered. A name is always required, though not necessarily for publication.

ON MAKING LEAD BENDS.

On making lead bends in plumbers' shops, a practical plumber from Boston writes us that the description of "L. D. H." in our issue of January 28, and his views regarding the making of lead bends, "covers the case entirely, being the way that plumbers generally make their bends in Boston."

STOP-COCK ON CIRCULATION-PIPE RESULT-ING IN AN EXPLODED BOILER.

LONDON, December 30, 1887.

SIR: In the articles on "Hot-Water Circulation" mention was made, page 491, Vol. XVI., of THE ENGINEERING AND BUILDING RECORD, of the improper practice of fixing stop-cocks in circulation-pipes. This evil has just been emphasized at a gentleman's country mansion. A new kitchen range had been fixed, the hotwater circulation-pipes had all been attached to the boiler,

and the work tested. A defect was found rendering it necessary to partly empty the boiler. Stop-cocks had been fixed in the circulating-pipes, and these were shut off during the time the repairs were being made, after which the fire was relighted, but the men forgot to open the stop-cocks. As the boiler was only partly filled with water, space was left for steam to generate. A short time after the fire had been lighted the boiler burst with great violence. The boiler was driven through a brick wall, and a portion of one of the plates buried four inches deep in another wall. A trussed iron roof, 23x20 feet, was lifted, and on falling back on the walls was found to have twisted six inches from its original position.

Seven men were seriously injured. One of them lies in the hospital, and his recovery is doubtful.

Culpable negligence was the cause of all this trouble, but the fact remains that it is a highly dangerous practice, which cannot be too strongly condemned, to fix stopcocks in circulating-pipes. If they are fixed, a safety-valve should be attached to the boiler; but it is best to avoid their use and so save the risk of an explosion.

Yours truly,

THE AUTHOR OF "ENGLISH PLUMBING PRACTICE."

ON MAKING LEAD BENDS IN PLUMBERS' SHOPS.

BOSTON, February 6, 1888.

SIR: Having noticed the article on making lead bends by Mr. Nicholson, of Milwaukee, in your issue of January 7, and the criticism of the method by L. D. H., of New York, I would say, that from experience in making bends of various sizes, both from lead and brass pipe, I believe that the blocks as shown by Mr. Nicholson have very decided advantages over the method used by L. D. H., inasmuch as they keep the pipe firmer, and give the workmen greater control over the pipe while in the act of forming a bend. We have used the blocks in our shop for years, and have them attached to our portable benches that we take on our jobs. As we use a great deal of brass pipe for supplies to water-closets and waste to bowls, and seldom anything but brass pipe for hot water, we find them of great utility in forming bends, curves, and offsets. Mr. Nicholson has done a service to a great many plumbers who have not had experience in making bends, by the very plain diagrams and descriptions. The giving of employment to workmen in winter by making bends of various degrees and sizes may do for some parts of the country, but I do not believe it would be profitable in this part, as nearly every individual fixture requires different treatment as regards bends, curves, and offsets.

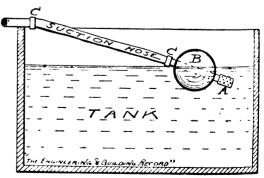
Respectfully yours, ISAAC RILEY.

PUMPING WATER FROM WATER-LINE IN CISTERN.

SIR: I have a contract to do some plumbing in which the specification requires that the suction-pipe of the pump should take the water from the cistern at or near the water-line wherever that water-line may be. It has been our custom to have the suction-pipe extend to near the bottom of the cistern. Can you suggest how this specification may be carried out?

C.

[We understand that in the vicinity of Boston water is taken from cisterns in this way. A suction-hose is arranged



with a suitably sized float, properly weighted, and attached to its immersed end. The hose is wired inside to prevent collapsing or kinking and of sufficient length to take advantage of its flexibility. One end is clamped or wired to the pipe, the other end to the float. The preferable method would be to pass the tube through the float, extending the end as indicated in sketch, so as to dip as much below water-line as desired. This end should have a brass strainer on it as shown.]



CAR-HEATING IN GREAT BRITAIN AND IRE-LAND.

A CORRESPONDENT of the New York Sun thus describes his experience:

his experience:

"The solemnity with which an ancient institution is accepted in Great Britain is astounding to the average New Yorker. Not long since I traveled from Cork to Dublin with four rare old Irish gentlemen. They did not know one another, but their affability was none the less cordial and sincere. The weather was bitterly cold. The railroad company had 'warmed' the section after the only plan known throughout the United Kingdom—viz., by filling a small can with lukewarm water at the beginning of the route, placing the can on the floor of the car, and washthe route, placing the can on the floor of the car, and washing its hands of the whole affair thereafter. By the time the car got to Cork the can was about as warm as the heart of a Manitoba blizzard. It lay in chilly isolation in the middle of the compartment floor until the Irish gentlemen straggled in spasmodically. They bowed to me and to each other after disposing of their parcels, and seated themselves comfortably. They all had hat-boxes, shawls. rugs, umbrellas, canes, and valises. No man thinks of taking a three hours' journey here without encumbering himself with more luggage than an American would carry on a week's trip. The oldest man of the quartet pushed the can affectionately into place in the middle of the floor, and, setting two large and substantial Hibernian feet upon it, smiled pleasantly on the others and said: the car got to Cork the can was about as warm as the heart

it, smiled pleasantly on the others and said:

"'There's room fur all, gintlemin.'

"They moved up and placed their feet side by side upon the chilly surface of the can until it was completely hid

from view.
"'It's a grand invintion, this,' muttered one of the of the quartet complacently. Then turning to me he said politely, 'Shall we make room for you, sir?'
"'Thanks, no; I'm not cold.'
"My teeth chattered so that I could hardly speak, but I

saw that the other passengers shivered too, much to my satisfaction.

satisfaction.

"'It's apt t' give wan chilblains, this intinse hate,'
remarked the oldest man sedately. He leaned over and
touched his finger to the can to see just how intense the
heat was. The finger nearly froze fast, but the old Irish
gentleman didn't turn a hair. He beamed paternally upon

gentleman didn't turn a hair. He beamed paternally upon the others,
"'Isit dangerously warrum?' asked his neighbor softly, leaning over, too. 'No,' he added, answering himself, 'it's phat I call extramely coomfurtable.'
"The others felt of it in turn, and then they all leaned back as imposing a group of beautiful liars as it has ever been my good fortune to see. Every man tried to bluff his neighbor into the belief that his feet were warm, and the curious point is that not only did they succeed in conthe curious point is that not only did they succeed in convincing each other, but in the course of an hour I grew so blindly envious of their apparently blissful condition that I moved up and begged for a corner for my own frozen extremities. After that I felt warmer in spite of myself.

"Travel in England at this season of the year is

far more barbarous than in the remote precincts of America. There is no heat, the trains wait four minutes at the small and seven minutes at the larger stations, and the only food is that found at the old-time Iuncheon counters along the route. I listened to a young Bestonian not long since while traveling from London to Liverpool. He was explaining the system of American Liverpool. He was explaining the system of American railroads to a square-jawed member of Parliament who was traveling in the same carriage. The Boston man had explained the great vestibule trains that run between Chicago and New York in glowing terms, commenting upon the 'dining-room cars, bath cars, smoking-cars, observation cars, and all lighted by electricity, and heated by steam,' with frenzied enthusiasm.

""Well I hope' said the M. P. when the American

by steam, with frenzied enthus asm.
""Well, I hope,' said the M. P., when the American had finished, 'that such amazing innovations will neval gain foothold heah.
""Why not? You are shaking like a leaf in a gale now.
Hadn't you rather travel in comfort?"
""No cir"

· · · Why?

"Because no man who travels in that manner can truly appreciate his home when he—ah—gets there."

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

HOW TO RAISE SEWAGE.

MADISON, WIS., February 2, 1888.

SIR: I wish to know the means usually employed in a system of sewerage to raise the same a few feet—from one to three—in order to get sufficient fall. If you have described any method in your journal during the last few years, will you kindly refer me to the same, or if there are any patented apparatus, will you give me the addresses of the manufacturers, and oblige,

Mc. C. Dodge.

[Presuming that it is the sewage, and not the system of sewerage which discharges it, that our correspondent wishes to raise from one to three feet, we would say that the means usually employed to that end are either direct pumping or the use of compressed air in an apparatus

called an "ejector," such as is used with the Shone System, which has been fully described in our columns. Where the lift is so small, perhaps a paddle wheel, working in an inclined trough, would be sufficient to throw it up and out. This, if water-power was available, could be conveniently driven by a water wheel on the same shaft. The address of the American representative of the Shone system is: The Shone Hydro-Pneumatic Sewerage and Water-Supply Company, 72 Commerce Building, Chicago, 1

TITLES OF PUBLICATIONS ON ABATTOIRS OR PACKING-HOUSES WANTED.

: Can you give us the titles of any works abattoirs or packing-houses, either in English or French?
OLD SUBSCRIBERS.

[We gave an answer to a similar question as above on page 742, issue November 26, 1887, Vol. XVI.]

INTERNATIONAL CONGRESS FOR THE IM-PROVEMENT OF INLAND NAVIGATION.

(From an Occasional Correspondent.)

WARSAW, January 20.

THE Third International Congress for the Improvement of Inland Navigation will be held at Frankfort-onthe-Main from the 20th to the 23d of August next, under the patronage of the Crown Prince of Germany. The Ministers of State, Von Boetticher, Maybach and Lucius, have each honored the congress by accepting the office of Honorary President.

The object of the Congress is to promote the interests of inland navigation by bringing together men of science, engineers, representatives of governments and of commerce-in short, all those interested in the matter-to read and discuss papers on various points of special interest to the general subject.

This question has latterly attained great importance in Europe. Steps are everywhere being taken to improve the navigation of rivers and to open artificial canals where natural water-courses are either wanting or insufficient. Thus Manchester is being connected with the sea by the great ship canal, on which work has just commenced; in Brussels and Paris designs for similar projects have been discussed for several years, and influential persons are doing their utmost to connect both those cities with the sea, so that ships can sail directly from all ports to these important capitals. St. Petersburg is enjoying the benefits of its ship canal, and the great ocean steamers can run up into the Neva without previous lighterage, and Bremen is deepening the estuary of the Weser to keep abreast of Hamburg, Rotterdam and Antwerp. great rivers of Germany-the Rhine, Elbe, Oder and Vistula—have been much improved by works of rectification. and latterly the German engineers have been following the example of their French colleagues, who have been the pioneers in this matter, and have begun to improve the navigation of the smaller rivers by "canalization" by means of movable dams. The river Main has thus been canalized, and the Rhine boats are able to run up to Frankfort with a draught of six and one-half feet. At Frankfort a port has been built with quays, warehouses, and granaries. These works on the Main were opened in October, 1886, and have already produced great results. Frankfort was, therefore, well chosen as the seat of the third congress.

These works and the new harbors of Mannheim and Mayence will be visited by the congress, as also the works on the Rhine. The labors of the congress will be confined chiefly to the four days set apart for the sessions. The following papers have already been selected for discussion: "The Improvement of the Navigation of Rivers by Rectification and by Canalization; "The Best Forms of Boats for Inland Navigation and the Best Means for Their Propulsion; "Inland Canals for Seagoing Vessels"; "Improvement of Estuaries and Deepening and Maintaining Channels in the Same"; "Improvements to be Made in Statistics of Inland Navigation"; "Advantages Derived by Agriculture from the Improvement of Rivers and Construction of Canals."

It is intended to have an exhibition of plans, drawings, and models in the building in which the congress will hold its session.

The Central Organizing Committee has been formed at Frankfort with the Mayor of that city, Dr. Miguel, Member of the Reichstag and of the Herrenhaus, as its

President, and active preparations have commenced. The congress will be visited by a large number of members from all countries.

It is sincerely to be hoped that American engineers will not be backward in showing their colleagues on this side of the water what they have accomplished in this direction. Much has been done by them, and on a scale that will interest and surprise their European brethren.

TESTS OF ELECTRICAL WELDING.

WE referred to Professor Dolbear the inquiry contained in our issue of January 21, and give below his reply.

COLLEGE HILL, MASS., February 5, 1888.

SIR: I have had made nearly a hundred tests of the tensile strength of electrically-welded bars of iron, steel, and other metals. The results were of such a character that I can state positively that with Thomson's welding process it is possible to weld both wrought iron and steel so that the weld is as strong as the same cross-section in another part of the bar; that the appearance of the fracture is fibrous for iron and generally granular for steel. the strength of this granular steel being on some samples as high as 125,000 pounds per square inch; that the process is such that the welding is homogeneous from necessity. I had a number of bars welded by an expert blacksmith, and a number of similar ones by the electrical process for comparison, with the result that the electrically-welded bars were much stronger than those welded by the ordinary process. The bars were of various sizes, up to an inch and a half for iron and three-fourths of an inch octagon steel. A. E. DOLBEAR.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

AN EXPLOSIVE SAFETY-PLUG,

MESSRS. LAYMAN, DEMPSEY AND COPPINGER, of Bolivar, N. Y., have jointly and severally invented a safety-plug for boilers on the homœopathic principle of preventing a big explosion by utilizing a small one.

Their plug contains a charge of powder or other explosive, which when exposed to excessive heat, by reason of low water in the boiler or formation of scale, etc., bursts the plug and relieves the pressure.

BRAZING AND WELDING BY OXYGEN GAS. WARRINGTON, January 7, 1888.

SIR: The cheapening of oxygen by Brin's process of manufacture has put into the hands of metal-workers a new power. I have recently made a few experiments with the compressed oxygen and coal gas, and found that with a 1/2-inch gas-supply a joint could be brazed in a 2-inch wrought iron pipe in about one minute, the heat being very short, the redness not extending over one inch on each side of the joint.

The appearance of the surface after brazing led me to experiment further with welding, a process which is not possible with ordinary coal-gas and air, owing to the formation of magnetic oxide on the surfaces. Contrary to my expectation, a good weld was obtained on an iron wire one-eighth of an inch diameter with a very small blowpipe, having an air-jet about one thirty-second of an inch diameter. This matter requires to be taken up and tried on a large scale, for such work as welding boiler-plates, which, it appears to be, can be done perfectly with far less trouble than would be required to braze an ordinary joint. The great advantage of this would be that the boilers would require no handling, but could be welded with an ordinary large blow-pipe in position, and with about onetenth the labor at present necessary.

The cost of the oxygen is trifling, and it is evident, from the results obtained in brazing, that the consumption of gas would be considerably less than one-fourth that necessary with an air-blast, irrespective of the fact that welding is possible with an oxygen blast, whereas it is not possible if air is used.

The surface of iron, heated to welding heat, by this means comes out singularly clean and tree from scale, and

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a small bottle of compressed oxygen, with a blow-pipe and a moderate gas-supply, would make the repairs of machinery, boilers, brewing-coppers, and other unwieldy apparatus a very simple matter. The trouble and difficulty of making good boiler-crowns, which so frequently "come down," would be very small indeed when the workman has an unlimited source of heat at command under perfect and instant control.

THOMAS FLETCHER.

Those of our readers who may wish to try this process can doubtless readily obtain all the oxygen they may need from those who manufacture it for calcium lights. The following is from the London *Engineering*, to which it appears Mr. Fletcher had addressed a similar letter:

LEEDS FORGE, LEEDS, January 24, 1888.

"SIR: With reference to Mr. Fletcher's letter published in your current issue, it may interest him and your readers to know that for years past we have, in the manufacture of Fox's patent corrugated boiler furnaces, been welding Siemens mild steel plates from ¼ inch to ¾ inch in thickness with ordinary gas and air, using a form of blow-pipe jet. The aggregate of our welding during the past year would be represented by some 20,000 lineal feet, the tubes being from two feet to five feet in diameter, to work at pressures as high as 200 pounds per square inch.

"The amount of oxide formed is dependent upon the relative amounts of gas and air employed, an oxidizing flame producing more and a reducing flame less. The surfaces of our tubes are perfectly clean of scale, showing absence of oxide.

"W. L. WILDY, Engineer,"

THE POTOMAC RIVER DAM FOR THE WASH-INGTON WATER-WORKS.*

THE water-supply of Washington, D. C., is taken from the Potomac River at a point about fifteen miles above the city. An island in the Potomac divides it into the Maryland and Virginia channels at the point where the upper end of the conduit is received, and the water was supplied from the Maryland side, which was dammed for the purpose. The extension of the masonry dam across the island and the Virginia shore and the raising the original portion to the same height by adding a 15-inch coping is the subject of this paper. The dam as finished is 2877 feet long and from 4 to 20 feet in height.

The lower side of the dam was rock-faced coursed work, the centre and lower part of up-stream wall was concrete, and the upper part of wall coursed ashlar. The river bottom was rock, with vertical ledges of blue gneiss of varying hardness. There was usually a long period of low water in summer, but sudden floods were at all time possible. The current at site was pretty strong, and carried large quantities of heavy drift wood. A rip-rap dam was built above the site of the masonry structures which it was intended to protect from floods.

A box coffer-dam was placed just below the rip-rap and the masonry built inside; when it was finished, the rip-rap was filled in next the masonry and furn shed the permanent backing. A track was laid on top of rip-rap dam and the larger stones brought on it to the end and dumped; smaller stone was floated down in scows.

The pumping was done by three 8-inch centrifugal pumps, estimated to discharge 10,000 gallons per minute, driven by portable agricultural engines, which proved very efficient and convenient, as in time of sudden floods they could be quickly run off to a place of safety.

When the ends of the dam were completed, leaving only a gap 150 feet long in the channel, cribs were built, 8x20x9 feet high, made of poles notched and bolted together and filled with stone. I hese were sunk above the line of the dam, stringers and a planking of 1-inch boards put on the up stream side, and bruch, sedge, grass, etc., filled in, making a barrier which deflected the water over the finished portion of the structure and reduced the depth at the gap to about one foot. Then short sections were enclosed with little dams of sand bags and clay, the water thrown out and the foundations laid.

The so-called Cumberland cements, "Round Top" and "Shepardstown," were chiefly used, except in the channel section, where "New York" and "Rosendale" were used.

NEW DRY DOCKS AT MARSEILLES.

ACCORDING to the *Genie Civil* the equipment of the port of Marseilles is just completed by the finishing of two improved dry docks of most recent and approved construction, which, added to the four previously in use and the old floating dock, afford ample accommodation for all requirements of vessels.

One of the old docks has a length of 180m. and 7m. depth of water on keel blocks; another measures 110m. two others 90m. each, and the two new ones are not less than 130m., with 6m. depth of water on keel blocks. Special machinery has been provided for the service of these new docks. Three engines and three pumps, capable of emptying one of the docks in an hour and a half, form part of the plant. The docks were constructed upon the plans and under the superintendence of M. Guérard, Chief Engineer of Ponts and Chaussées, and the plant was furnished by the Mediterranean Forge and Shop Company.

A BRIDGE SUPPOSED TO DESTROYED BY FROST.

A SHORT time ago a suspension bridge which spanned the River Oise at Merv fell bodily into the river during the night. Fortunately, nobody was on it at the time. The bridge was built in 1827, destroyed by the French in 1870 before the advancing Germans, and reconstructed in 1872. The London Ingineer says that the cause of the accident is supposed to have been the contraction of the iron by the sudden severe frost.

THE PROPOSED SUPPLY OF WATER BY METER IN THE CITY OF LONDON.

By the report of a recent meeting of the Court of Common Council of the city of London, given in the Journal of Gas Lighting, it appears that three years ago the corporation had introduced a bill in Parliament providing among other things for the supply of water in London by meter. It was defeated by only a small majority and it is proposed to reintroduce it an early day. The opinion was expressed that the citizens should be supplied with water by meter and that the water companies should be compelled to thus supply it.

A NEW OIL-PIPE LINE.

The Standard Oil Company proposes to build an immense pipe line from Lima, O., to Chicago to transport oil for fuel purposes. The right of way is being secured, and preparations made for construction. This is the beginning of the proposed 1,000 miles pipe line between New York and Chicago. There has been in use for some years a pipe line from the cil fields of Western Pennsylvania to New York, which will form the eastern connection.

THE WORLD'S ELECTRIC INDUSTRY.

UNDER this title the London *Electrician* gives some very suggestive figures. It says that in the United Kingdom there are 229,000 miles, or thereabouts, of public telegraph wires employing 23,868 persons, and on the world's telegraph lines, approximately amounting to 1,800,000 miles not including submarine cables, a total number of 179,708 persons find their occupation exclusively in telegraphic signalling operations. This, of course, does not include railway and post-office officials whose telegraphic duties occupy but a part of their time and by whose addition the aggregate would be greatly increased.

Taking the same basis of exclusive occupation, there are about 6,000 persons, almost all British, engaged on submarine cables and some 30,000 on telephones, a total of 216,000 operators.

The electric-lighting industry employs about 100,000 persons, of whom about 5,000 are in Great Britain, and adding to this some 5,000 persons employed in the manufacture of electric cables and insulated wires, gives with the 216,000 operators a grand total of 320,000 people. About 100,000 more are engaged in Great Britain in industries which but for the practical utilization of electricity would have no existence. Reckoning three to a family, these industries provide support for 300,000 people, and multiplying this by the proportion which the electrical industries of that country bear to the rest of the world, it is concluded that at least 5,000,000 people would have to look to other means of subsistence if electricity and its commercial applications had not been made known to men.

FOG AND GAS.

A RECENT foggy day in Marchester, England, caused a consumption of 19,974,000 cubic feet of gas in that city, against 14,378,000 cubic feet consumed on the same day of the previous year, the latter being about a fair average for the season.

LIGHTING AND HEATING RAILWAY CARS IN EUROPE.

THE Chronique Industriel'e reports that at a recent conference in Milan questions relative to this subject were discussed. It was stated that flat-wicked lamps burning vegetable oil gave some satisfaction, those burning mineral oil are preferred, and gas is entirely satisfactory but found inconvenient to supply. Results of experiments with electricity forbid its use until lamps and generators are much further perfected.

"Warming is considered a more delicate question on account of the diversified tastes of the traveler." Portable foot-warmers are much used, the Radelet footwarmer, whose heat is supplied by metal bars of high temperature, and the acetate-of-soda foot-warmer satisfactorily retaining their efficiency. Many trials have been made with fixed and semi-fixed foot-warmers. The methods of heating by hot water, or steam furnished by the locomotive, or a special boiler carried on the train, are also employed, but present considerable difficulty in arrangement, connections, etc. Both warming and lighting were eventually pronounced open questions.

WESTERN PENNSYLVANIA ASSOCIATION OF ARCHITECTS

At the last annual meeting of the Western Pennsylvania Association of Architects, held in Pittsburg last month, the following officers were elected: President, Andrew Peebles; Vice-President, George S. Orth; Secretary, L. O. Danse, C. E.; Treasurer, Joseph Anglen; Directors, Thomas M. Boyd, C. E., Joseph Stillburg, I. V. Evans.

MINNEAPOLIS SOCIETY OF CIVIL ENGINEERS.

THE Minneapolis Society of Civil Engineers has just elected the following officers: President, W. A. Pilce; First Vice-President, E. B. Abbott; Secretary, Walter S. Pardee; Assistant Secretary and Treasurer, B. O. Huntress; Librarian, W. W. Redfield; Member of the Board of Managers of the Association of Engineering Societies, Andrew Rinker; Standing Committee on Membership, Andrew Rinker, M. D. Rhame, R. A. Sanford; Committee on Entertainment, George W. Sturtevant, F. W. Chappelon; House Committee, W. W. Redfield, S. C. Deverly.

COMPRESSED AIR FOR POWER PURPOSES.

THE works for the public supply of compressed air to the town of Birmingham, England, have been pushed forward vigorously during the year 1887. The present contracts for engine power are for three triple expansion engines each of 1,000-horse power. The buildings for this installation and for a further 1,000-horse power are completed, and the engines are in course of erection. The steam-boilers on the "Lane" system are erected for six engines, as are also the gas producers by which the steam is generated. The mains for distributing the compressed air from the central station are being laid through the town, the largest size being twenty-four inches in diameter, which is now being laid, together with others of twenty inches and eighteen inches diameter. They are wrought iron, and are jointed by what is known as the "Kimberly" joint. They are laid in either concrete or brick trenches. By the time that the mains are laid the engines will be ready to deliver air to the large number of consumers on the company's list. The commencement of the public supply of compressed air motive power in Birmingham is expected to be about April, so that the works will be in full operation by the middle of the year. MM. Petit and Boudenoot have had engines of about 300 horse power at work for some time supplying compressed air to motors in the St. Avoye quarter in Paris. The results have been so satisfactory that the system is being rapidly extended, and during the past year Messrs Davey, Paxman & Co., of Colchester, have supplied an immense plant of engines, boilers-these latter of the marine type-and air-compressors to a French Company.

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^{*} Abstract of a Paper read before the American Society of Civil Engineers, February t, 1838, by S. H. Cnittenden, M. Am. Soc. C.E.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

CANTON, O.—Plans are wanted here for fwo brick school buildings, until March 5. Address the Board of Education.

METHODIST BOOK CONCERN BUILD-

MR. E. H. KENDALL, of New York, has been selected as the architect of the new office building of the Methodist Book Concern. It is to be on south west corner Twentieth Street and Fifth Avenue; 100x175 feet and ten stories high



For works for which proposals are requested see also the "Proposal Column," pages v-vi-vii-175.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

NEW YORK CITY.—See our Proposal Column for important advertisement of proposals wanted for furnishing and delivering cast-iron pipe and special castings, laying the same, etc., by the Aqueduct Commission.

EUSTIS, KAN.—John Boyd, City Clerk, writes as follows: "Our city has voted waterworks bonds and are negotiating for the works, same to be completed as soon as possible."

CUBA, N. Y.—The President of the Common Council of this place writes us concerning the water-works question as follows: "The taxpayers are at present agitating the question of a thorough system of gravity water works which would afford ample fire protection for the village. A vote will probaby be taken soon. I judge the sentiment at present to be about equally divided for and against the project with the favorable side gaining ground by agitation."

COUNCIL BLUFFS, IA.—The Council Bluffs Water-Works Company has increased its capital stock from \$750,000 to \$1,000,000. Extensive improvements are contemplated in the near future.

SALT LAKE CITY, UTAH.—The Special Committee on Sewerage has presented its report to the Common Council and the matter is now in the hands of that body. The report recommends an improved form of the pipe system, and estimates the cost at from \$112,500 to \$185,500. Early developments may be expected.

WILLIMANTIC, CONN.—George W. Melony, of this town, under date of February 8, writes us as follows: "It may be of interest to readers of your Contracting Intelligence columns to learn that this borough voted last fall to construct 6,600 feet of main sewer early in the coming season, this section to be part brick and part vitrified tile and to cost nearly \$25,000. A special committee, of which I am a member, has been appointed to make contracts, etc., and we are now looking for a construction engineer to prepare detail plans immediately and supervise the work."

Washington, Mo.—The taxpayers of this place have presented a petition to the trustees asking for a special election to submit the question to voters as to whether water-works shall be established. Messrs. Jones, Hagebusch and Beinke were appointed a special committee to make necessary arrangements for such election.

LOUISVILLE, KY.—The Louisville Water Co. advertises for proposals for building en-

gine-house, furnishing pumping-engine, and building river and inlet work. See our Proposal Column.

ALLEGHENY, PA.—At a meeting of the Water Committee, held February 6, the question of submitting to councils a printed report relative to securing a better supply of water was presented.

The report includes three plans of obtaining water from Nine-Mile Island, which are described as follows: "The first plan embodies a system by which the water is pumped into a steel delivery main at such a pressure as to distribute it at the highest points in Allegheny City at an estimated cost of \$1,500,000. The second plan is essentially the same, with less powerful engines and without a rising main, by which the water is sent to Allegheny City and then elevated by the present water-works engines, and will cost \$1,261,408.90. The third plan includes the first plan, with the addition of reservoirs or settling-basins, and would cost \$2.581,936."

MAYNARD, MASS.—The water-works question is being agitated.

WOLFBORO, N. H.—This place has voted in favor of water-works

CHEYENNE, W. T.—The question of improving the water-works system here is being discussed by the city officials and it is probable that steps toward that end will soon be taken. A system of storage reservoirs is regarded as the most teasible and the estimated outlay for the proposed improvements is \$20,000. Donald Miller, the City Clerk, can give details.

GORDONSVILLE, VA.—Reports state that a system of water-works will soon be established here.

LAKE, ILL.—On January 31 the Board of Trustees adopted the plans and specifications submitted by Mr. Horn, the Town Engineer, for a sewage pumping station upon the Shone hydro-pneumatic system. The pneumatic ejectors will be placed underneath the surface of the street at the intersection of Sixty ninth and Halsted Streets. They are to be capable of lifting twelve hundred gallons of sewage per minute against a head of thirty feet. The air-compressors will be placed about 700 feet from the ejectors.

MYERSDALE, PA.—Concerning water-works matters here our correspondent writes us, under date of February 7, as follows: "A company has been formed, named Myersdale Sand Spring Co., and a charter obtained. Last night the Council granted right of way to lay pipes, etc., in the town and the Executive Committee is pushing the matter as fast as possible, but the work will not begin before spring and is not under contract yet."

WINNEPEG, MAN.—Concerning the report that the sewerage system here was to be extended our correspondent writes as follows: "Plans and estimates have been submitted covering about three miles of extensions at an estimated cost of \$38,000, but have not yet been decided upon."

LYNN, Mass.—Concerning the report that the water-works here were to be extended our correspondent writes as follows: "No steps have been taken as yet to extend these works beyond a petition to the Legislature for liberty to increase the bonded debt. Probably the pumping capacity and more storage will have to be provided in the near future."

Toledo, O.—The Superintendent of the Water-Works has been ordered to advertise for bids for a new pumping engine of 10,000,000 gallons capacity, and for the sale of the two old Worthington engines of the capacity of 5,000,000 gallons each. Also to advertise for bids for laying a submarine line, 16-inch main, across the river. See the Proposal Column.

BUFFALO, N. Y.—The Board of Water Commissioners has submitted a communication to the Common Council favoring improvements to the water-works plant, which will necessitate the addition of new storage and distributing reservoir, a 20,000,000 gallon pumping-engine, and two lines of mains, one 36 inches and the other 42 inches. The Common Council will consider the matter at once.

STERLING, Col.—A water works system to cost \$40,000 is to be established here this spring. The water will be furnished by some springs lying six miles north of Sterling, the head of the water-supply being 125 feet above the town, which alone gives a good water pressure.

MILTON, MASS.—It is reported that there are two schemes on foot here for furnishing a water-supply. The Water Committee can give details.

PHILADELPHIA, PA.—The Water Committee has ordered that plans and specifications for the fitting up of filters be drawn by one of those tendering for the supply of the same. The plans will be for a plant with a purifying capacity of one million gallons per day, including all the water used in the building.

MEMPHIS, TENN.—The Artesian Water Company, which began operations here six months ago, with a capital stock of \$100,000, has purchased the plant of the old water company, which supplied the city from Wolf Creek, for the sum of \$55,000. The new company will issue \$750,000 in stock and \$500,000 in bonds. Seven hundred thousand dollars will be expended in improvements at once. There are now 35 miles of pipe, and 15 miles are to be added. A stand-pipe 225 feet high will be built, and two pumps of a capacity of 10,000,000 gallons a day erected. The water will be drawn from 20 wells, which will be linked together. The average depth will be 500 feet, and the flow adequate for a city of twice this size.

NEBRASKA, CITY, NEB., has just accepted completed plans of grade and sewer-system and proposes to go ahead with the construction at once. Messrs. Rosewater & Christie, Omaha, Neb. who designed the plans, will have charge of the construction.

OTTAWA, KAN.—Messrs. Rosewater & Christie, of Omaha, Neb., have just completed plans and specifications of a system of sewerage for this city. The plans have been accepted and arrangements are being made to proceed with construction of a part of the system early in the spring.

MILTON, MASS.—Concerning the proposed water-works project here the Chairman of the Water-Works Committee writes us as follows: "The Milton Committee on Water-Supply have reported to the town that on account of the great cost and small income that it would be inexpedient for the town to build a system of water-works at the present time. The estimated cost of the proposed works was \$275,000. Operating expenses. \$5,000. The fixed charges and operating expenses amounted to \$21,000, and the income from hydrants and water takers to but \$12,000, and on account of the prospective large annual deficit we made the report I stated."

LAKE, ILL.—The trustees of this place will readvertise for bids for the proposed watermain. It has been declared by the Town Attorney that the bonds lurnished by the lowest bidder on the previous award were excessive, hence the new move.

BELLVILLE, ILL.—The City Water Company has purchased thirty acres of land near their present reservoir, in which, with the opening of spring, they will construct a new reservoir twenty feet in depth, and having five times the capacity of their prsent large reservoir, so as to provide for an ample supply of water at all times.

SUNDANCE, Wv.—It is reported that waterworks will be established here.

FRENCHTOWN, N. J.—The water-works system of this place is to be improved. Address S. D. Hagerman, Town Clerk.

IRON MOUNTAIN, MICH.—City Clerk F. Crocker, it is said, can give details of a proposed water-works system for this place.

WICHITA, KAN.—Plans and specifications for a system of sewerage for this city have been adopted and work will be begun in the spring. The plans were prepared by Messrs. Rosewater & Christie, of Omaha. The estimates show that the system will embrace 85 miles of sewers to cost \$365,000.

CHAUTAUQUA, N. Y.—The water-works at this place are to undergo improvements.

OWATONNA, MINN.—City Clerk E. M. Trice can furnish details of proposed waterworks system.

BRIDGES.

BAY CITY, MICH.—There is to be considerable bridge building here.

WHEELING, W. VA.—The election by the voters of Wheeling and Ohio Counties on the question of voting the sum of \$300,000 toward building a Union bridge across the OhioRiver at this point resulted in favor of the measure, and work on the new enterprise will begin at once. The City Engineer of this place will furnish details.

PORTLAND, ME.—At a recent meeting of the Maine Central Railroad directors it was voted to replace some eight of the short wooden bridges between Portland and Vanceboro with iron structures. The cost will be about \$50,000. The directors have also decided to construct 400 flat and box cars at the Waterville shops next summer, the cost of which is estimated at \$400,000.

SMITH'S FAILS, CAN.—Reports say that a large bridge is to be erected here.

BRIGHTON, N. Y.—It is reported that a large bridge is to be erected here.

BUFFALO, N. Y.—It is reported that the Erie Railroad will erect a \$100,000 bridge here. Chief Engineer Buchholtz, of the Erie, can give details.

ST. PAUL.—The Board of Public Works recommend an appropriation of \$10,000 for the construction of approaches to the Dale Street bridge.

MISCELLANEOUS.

NATIONAL, CAL.—It is proposed to petition the City Council to order a special election for the purpose of issuing city bonds to the amount of \$100,000. The money is needed for the purpose of making public improvements—a fire department, city hall, fire-plugs, etc., being contemplated.

CHATTANOGA, TENN.—The Committee on Commerce has reported favorably the joint resolution to appropriate \$75,000 for continuing the improvement of the Cumberland River above Nashville, with a view to securing a depth of four feet in the channel. Part of the money is authorized to be used in the purchase of sites for necessary lock and dams.

NEW CORPORATIONS.

THE Morden Brake Beam Company, of Chicago, Ill., capital stock, \$400,000, to deal in appliances relating to car brakes; incorporators, Franklin H. Watriss, George C. Wilson, and other

The Bowers Dredging Company, of Chicago, Ill., capital, \$200,000, to do a contracting business; incorporators, A. L. Amberg, L. W. Bates, and others.

THE Spring Valley Elevator Company, of Spring Valley, Ill.; capital, \$20,000; incorporators, I.ouis Ackerman and others.

THE Smith Feed Water-Heater and Purifier Company, capital stock, \$50,000; incorporators, C. E. Bleyer, T. A. Walsh, and others.

THE Chicago and South Side Rapid Transit Railroad Company, Chicago, Ill.; Will H. Clark, and others, incorporators.

THE San Diego and Elsinore Railway Company, San Diego, Cal.; capital stock, \$2,000,000; C. C. Stevenson, and others, incorporators.

THE Cedar Rapids Belt and Southwestern Railway Company, Cedar Rapids, lowa; capital stock, \$500,000; J. May, and others, incorporators.

THE Santa Ana, Fairview, and Pacific Railroad Company, Santa Ana, Cal.; capital stock, \$60,000; A. L. Clarke, and others, incorporators.

THE Electrical Manufacturing Company, Newark, N. J. Capital stock, \$5,000. Paul W. Roder and others, incorporators.

The San Francisco Steam Company, San Francisco, Cal. Capital stock, \$5,000,000. P. T. Dickenson, and others, incorporators.



SCRANTON, PA.-Address W. J. Lewis, of the Suburban Electric-Light Co., for details of some new electric-light work.

LAKE, ILL.-C. S. Armstrong has applied to the Trustees for a franchise for an incan-descent electric light and power plant for the purpose of supplying electric light and power to private residences.

BUFFALO, N. Y. — Our correspondent rites: "In your issue of last Saturday I see a denial from a city official of the report that the Thomson-Houston Electric-Light Company would spend \$40,000 for a plant and building here. I did not furnish you with the report, but if it was not true then, it is now. I am at a loss to understand why it should be denied by a city official. If that official would like a little information on the subject, just tell him that the company has purchased a lot on Court Street near Pearl, and has also started a building which will ultimately be carried up six or seven stories, but only two stories at present. The architect of the building is H. H. Little. I do not know what the plant and building have cost the company, but certainly not less than \$40,000, as it is in the central part of the city.

DAVENPORT, IOWA.—The People's Light Co. has been incorporated in this city, with James Thompson as President. The capital stock of the company is \$10,000. The company has applied to the City Council for a charter and right of way. It is proposed to make use of the Moline water power in the securing of electricity for purposes of illumination.

HEMPSTEAD, L I .- The Town Board of Commissioners of this place has given permission to the Hempstead Gas Light Company to extend its system of electric lighting one mile in all directions beyond the village limits.

RAVENNA, O.—An electric light plant to cost \$12,000 is to be established here.

PORT HURON, MICH.—Electricity is to take the place of gas as an illuminator here.

KENOSHA, WIS.—The city officials have decided to establish an electric light plant.

STOUGHTON, MASS.—This place is to be lighted with electricity.

CHICAGO, ILL.—A project to supply this city with unlimited quantities of natural gas for fuel and illuminating purposes is developed by a combination of capitalists, some of whom live in Chicago and others in Philadelphia, W. W. Gibbs, of Philadelphia, Pa., is at its head.

Spencer, Mass.—Electric lights are to be

BIDS OPENED.

FOND DU LAC, WIS .- The following bids for lighting the public streets were opened February I by the Committee on Public Light-

ing:
Fond du Lac Gas Light Co., two proposals, as follows: First-To furnish any number of as follows: refs:—10 turns any number of electric lights, at the rate of \$72 per year for 2,000 candle power, or \$50 a year for 1,200 candle power, at the option of the city. Location of lamps to be fixed by the city. Schedule of lighting same as now used. Contract to run five or ten years. Second—If gas and electricity are used in combination, to furnish the electricity at the rate of \$50 per year, and the gas lights at \$25 per year, the number and location of lamps to be fixed by the city. Schedule of lighting as at present. Contract to run five or ten years. If a liberal number of gas lamps are used, the price of gas to private consumers will be reduced.

L. O. Hill & Co., Fond Du Lac, proposed to furnish ten more arc lights than are now used by the city, at a cost of \$4,350, the contract to run two, three, or five years.

The first proposal would distribute in the city 83 lamps of 2,000 candle power, or 120 lainps of 1,200 candle power. The old contract called for 20 lights.

Under the second proposal the city could have 60 electric lights of 2,000 candle power and 120 gas lights for \$6,000.

No award has as yet been made

No award has as yet been made.

CEDAR FALLS, IOWA.—Synopsis of bids for constructing a system of water works under plans prepared by Loweth & Curtis, civil engineers, of St. Paul, Minn, opened anuary 31 by Council Committee on Water-

R. D. Wood & Co., Philadelphia, Pa., hyc. D. wood & Co., Philadelphia, Pa., hydrants, \$30.50, \$31.25, \$33.00; 8 inch valves, \$23.00; 6-inch valves, \$16.00; 4-inch valves; \$10.00

Gordon & Maxwell, Hamilton, Ohio, pump, 10x10¼x12, \$2,680; pump, 18x10¼x-18, \$3,060; boiler, \$1,010. Shickle, Harrison & Howard Iron Co., St.

Louis, Mo., pipe, \$30.40; special castings, 3 cents.

Detroit Pipe and Foundry Co., Detroit.

Mich., pipe, \$30.80; special castings, \$46.50.
Dennis Long & Co., Louisville, Ky., pipe, 4-inch, \$32.75; 6 and 8-inch, \$31.75; special castings, 3½ cents.
American Water & Gas Works Construc-

tion Co., Chicago, Ill., entire work, \$16,800.
Eclipse Wind-Engine Co., Beloit, Wis., en-

tire work, \$20,560.

W. T. Casgrain & Co., Milwaukee, Wis.,

W. T. Casgrain & Co., Milwaukee, Wis., entire work, \$19,357.

D. Kennedy, New York, hvdrants, \$27; 8-inch valves, \$21; 6-inch valves, \$12.50; 4-inch valves, \$8.50; valve-boxes, \$5.

Hodgman Bros., St. Paul, Minn., pipe, \$30.65; hydrants, \$30.60; 8-inch valves, \$22.50; 6-inch valves, \$15.25; 4-inch valves, \$10.25; valve-boxes, \$5.50; specials, \$60.

Sturtevant & Carr, Minneapolis, Minn., entire work, \$23.617.

entire work, \$23,617.

Pond Engineering Co., St. Louis, Mo., pumping plant, \$3,220.

Deane Steam-Pump Co., Holyoke, Mass., pump, 18 ½ x10x18, 共1,430; pump, 18 ½ x10x-10, \$3,350; no bid on boiler.

— Robinson, Cedar Falls, Iowa, engine-

house, \$1.750.

Weisbard, Cedar Falls, Iowa, engine-

— Weisbard, Cedar Falls, Iowa, engine-house, \$1,333.52.

National Tube-Works Co., Chicago, I'l., hydrants, \$34.50; 8-inch valves, \$23.95; 6-inch valves, \$15.95; 4-inch valves, \$9.95; valve-boxes, \$4.50.

— Connors, Cedar Rapids, Iowa, pipe, \$38; hydrants, \$40; 8-inch valves, \$26; 6-inch valves, \$18; 4-inch valves, \$13; valve boxes, \$10; specials, 3½c.: pump-house, well, and filter-gallery, \$3,257.

Dennis & Cornell, Muscatine, Iowa, entire

Dennis & Cornell, Muscatine, Iowa, entire work, \$18,400.

Addyston Pipe & Steel Co., Addyston, O., pipe, 8 and 6 inch, \$31.50; 4-inch, \$32.50; specials \$60.

The contract was awarded to the American Water and Gas Works Construction Co.

WILLIAMSPORT, PA.— Supplemental bids for the First and Second Sewer Districts: Jacoby & Madden, Bridgeport, Conn., \$83,-645.76; B. J. Coyle & Co., Washinton, D.C., \$84,145.76; J. J. Cogan, Bergen Point, N. J., \$86,231.45; Nagle & Co., Elmira, N. Y., \$78,623.53. Bid of Nagle & Co. was recommended to councils mended to councils.

NEWPORT, Ky. -Synopsis of bids for water-works furnishings, opened February 6 by B. R. Morton, Superintendent of the

water-works numbers, openintendent of the Water-Works:
Bingham & Taylor, Buffalo, N. Y., service-boxes, \$1; Globe Foundry, Cincinnati, O., service-boxes, \$2; James McDonald & Sons, Cincinnati, O., lead pipe, 53/c.; solder, 21c. Robert Hesterburg & Co., Cincinnati, O., ½-inch stop-cocks, 50c.; ½-inch service-cocks 50c.

George Fewless. Cincinnati, O., 1/2-inch stop-cocks, 51c.; ½-inch service-cocks, 53c. Alex. Rigler, Cincinnati, O., ½-inch stop-cocks, 55c.: ½-inch service-cocks, 55c.

Bourbon Copper and Brass Works, Cincinnati, O., ½ inch stop cocks, 60c.; ½-inch service-cocks, 6oc.

service-cocks, 6oc.

Troy Globe Valve Co., Troy. N. Y., ½-inch
stop-cocks, 6oc.; ½ inch service-cocks, 6oc.

William White, Newport, Ky., excavating
and plumbing service branches, \$2.26; extra
labor. repairs, etc., plumber and helper, per

George J. White, excavating and plumbing service branches, \$2.75; extra labor, repairs, etc., plumber and helper, per day, \$4.50.

The contract for the lead pipe was awarded to James McDonald & Sons; stop and service

cocks to George Fewlass; excavating and other labor to William White.

TOLEDO, O.—The Water-Works Board has signed a contract with the Ohio Pipe Company for 250 tons of iron pipe at \$25.83 per ton, or \$6,457.50.

CLEVELAND, O .- The following bids for

CLEVELAND. O.—The following bids for fire-proof vault were received by John Whitelaw, Water-Works Superintendent:
W. Y. Latimer, Cleveland, \$933; McMillan & Collister, Cleveland, \$800; J. Mahan, Cleveland, \$919; J. Barclay, Cleveland, \$1,095; J. Yawne & Son, \$925; J. Reardon, \$1,014; S. C. Kane, \$1,108; J. Gill & Son, \$917; F. Hostrung, \$808; H. C. Spooner & Son, \$1,030; J. Hill, \$769; A. Doll, Jr., \$690; Tasker & Loesch, \$847; J. Hardman, Jr., \$898.40; F.

Campbell, \$1,250; Schulze & Stucher, \$898; Geo. Young, \$800. The contract was awarded to A. Doll, Jr.

MILWAUKEE, WIS .- The Board of Public Works opened bids February 7 for the construction of 226 feet of docking on the river and for the flushing-tunnel. They were made by W. T. Casgrain at \$3,600 for the outlet complete, and by G. H. Starke for \$3,780. The as to oak piles, street piles, and dock timbers were the same at \$600, \$50, and \$50 per 1,000 feet respectively; those for rod-iron tie-rods differing \$4.45 in favor of Casgrain.

St. Paul., MINN.—The Economy Steam-Heat Company has been awarded contract for putting in temporary plant in the new court-house and city hall.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following is an abstract of bids opened January 30 for general excavation and piling for Custom House, etc., at Key West, Fla.:

McDermott & Higg, amount for performing

McDermott & Higg, amount for performing the work according to the drawings and specifications, no creosoting required. \$10,647.17. Colin McK. Grant, \$14,000; \$5,000 additional if piles are creosoted.

George W. Egan, \$11,400; \$3,000 additional if piles are creosoted; \$9,000 deduction if uncreosoted piles only are delivered. \$6,800 deduction if grossted piles only are delivered. \$6,800 deduction if grossted piles only are delivered.

deduction if creosoted piles only are delivered.

McCarthy & Baldwin, \$13,889. Kelly Bros., \$12,950.

MACON, GA.—Synopsis of bids for steam-

MACON, GA.—Synopsis of bids for steam-heating, etc., in the public building, opened February 7 by the Supervising Architect of the Treasury Department: Bartlett, Hayward & Co., \$5,940; Nash-ville Machine Co., \$11,337; L. E. Millen, —; S. I. Pope & Co., \$5,937; William Kirkup & Son, \$5,150; Charles A. Robbe, \$7,285; Ihomas C. Bassher & Co., \$6,268; Weston Engine & Machine Co., \$6,250.

COLUMBUS, O .- Synopsis of bids for approach changes to the public building, opened February 7 by the Supervising Architect of the Treasury Department: Platform and steps, mailing buffer, masonry and storm doors McCarthy & Baldwin, \$1,487. For raising grade and driveway—M. B. Abbott, \$290.

LEAVENWORTH, KAN.—Synopsis of bids for slate and metal work of roof, flag staff and frame hood over scuttle for the court-house, opened February 2 by the Supervising Architect of the Treasury Department: Morgan, Thomas & Co., Washington, D. C., \$2,399; Kansas City Slate Co., \$3,800; A. K. Sweet, Kansas City. \$3,453.87; William T. Yoakum, Leavenworth, Kan., \$4,900; Varney Heating and Mfg. Co., Leavenworth, Kan., \$3,100; William E. Roach, \$2,596; Kinsely & Miller, \$2,906. frame hood over scuttle for the court-house \$2,006.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apart inch-house: len, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

562-564 7th av. 2 br tens; cost, each, \$9,000; o, John G Wendel; lessee, Anton Ehrman; a, Rentz & Lange.

560, 562 and 564 7th av, rear, br stable; cost, \$8,000; o, lessee, and a, as above.

411 E 75th, stone ten; cost, \$9,000; o, H M Cadden; a, F T Camp.

945 10th av, br ten and store; cost \$16,000; o, Philip Spengler; a, Thom & Wilson.

157th, n s, 225 e Courtlandt av, br ten; cost, \$9,500; o, Katharine Doelle; a, A Pfeiffer.

Courtlandt av, s w cor 140th, 3-story br ten and store; cost, \$10,000; o, John H Bohling; a, A Pfeisser.

Bathgate av, n w cor 183d, 6 br and fr dwells; cost, each, \$3,000; o. Charles Barnes; a and b, J J Barnes. Fulton av, s w cor 169th, br and stone

dwell; cost, \$75,000; o, John Eichler; a, De Lemos & Cordes.

442-444 West 50th, 2 br tens; cost, \$20,000 o, Trustees of Henry Astor; a, James W

S w cor 116th and Fourth av, br flat; cost, \$30,000; o, Max and Moses Ottinger; a, A B Ogden & Son.

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304 Delancey, br flat; cost, \$20 000; Anna Albers; a, Kurtzer & Rohl.

N w cor Great Jones and Lafavette Plan br store, cost, \$150,000; o, Mrs E Scherze horn; a, H I Hardenburg.

S s 68th, 100 w Second av, 5 br dwells: 28 \$50,000 all; o, Auchimutz & Schermerhore: as above

N s 88th, 200 e Second av. 3 br tens; or \$42,000 all; o, Frank A Wihlein; a, Edwa

S s 83d, 275 w 8th av, br dwell; cost &: 000; o, Philip Daly; a. John Sexton.

247 Division and 258 East Broadway, workshop; cost, \$27,000; o, Gross & Bross a Herter Bros.

72, 73 and 74 West, 3 br stores and dwo cost, \$21,000 all; Est of William Edga; a ceased; a, H J Hardenburg. N s 112th and s s 113th, 100 w 8th av. 16

dwells; cost, \$160,000 all; o, HW Smit; William H Boylan. 223-225 West 19th, br stable and dwe

cost, \$15,000; o, James Simpson; a, Herice Pirsson & Co.

ALTERATIONS-NEW YORK.

163d, n s, abt 200 e 3d av, stone extensions, \$7,500; o, Schnorer Club; a, A Piete 873-879 Broadway, 2 br stores; cost, \$100 000; o, Soloman Leib; a, De Lemos à Corc-635-637 Sixth, br tens; cost, \$24.000 Est of David Jones; a, D & J Jardine.

BROOKLVN

Stockholm, w s, 80 e Evergreen av. four (brick filled) tens; cost, \$20,000; 0, a and Joseph Frisse.

Beaver, e s, 400.10 s Flushing av, 2 fram (brick filled) tens; cost, \$15,000; o and b. Jab Freitag; a, Th Engelhardt.

Sw cor Evergreen av and Prospect st. b storage; cost, \$12,000; o. L Liebmann & St a, Th Engelhardt.

S s Kosciusko st, 275 e Sumnerar, 4b dwells; cost, \$19,000 all; o, Rich C Addy; 2 owner.

N e cor Classon av and Bergen st, 37 dwells and stores; cost, \$25,000 all; 0, Jets P. Wierck; a, Th Engelhardt.

Secor Lewis and McDonough, br size and dwells; cost, \$16,000; o, John F Ruz. a, Amzi Hill. E s Central av. 75 s Grove st, 2 fr dress and stores; cost, \$8,000 all; o, H Vollweite.

a. owner. N s Cornelia st 100 w Bushwick av. ch dwells; cost, \$15,000 all; o, R B Miller. 4 David Acker & Sons.

Secor First and Leonard sts, fr store and dwell; cost, \$10,000; o, D M Koehler; a, V Hugo Koehler.

W s Manhattan av, 65 s Monroe av. 2 fr stores and dwells: cost, \$7,000 all; o, Randall & Miller; a, same.

KEY WEST, FLA .- Edward H. Gato, the Havana cigar manufacturer, will erecome of the largest cigar manufactories in the United States here this spring. The builting is to be of brick, iron and stone with a capacity for 1,000 cigar-makers, enabling them to manufacture 200,000 cigars a day.

BOSTON, MASS.—State and Doane st. banks and offices; cost, \$250,000; o. Fish estate; a, Peabody & Stearns; b. Norcess Bros.

125 and 127 Purchase st, br mercantile cost \$26.000; o. Joseph Gahm; a, L. Weibeim; b, James Fagan.

Newburg st, near Parker, 3 brick drecost, \$36,000; o. F. R. White, et al. b. f. J. Tobey; b, F. R. White, et al.

Caledonia st, 2 br dwell; cost, \$28,000. o, Seth R. Baker; a, E. N. Boyden. St. Botolph st, 2 br dwell; cost, \$77,000 o, Seth R Baker; a, E N Boyden.

ST. PAUL, MINN .- Nothing over \$7,000 in value to report.

LOS ANGELES, CAL.-Mr Samuel | f Thayer, of Boston, Mass., is the archited of a new hotel, to be built of stone and brick at a cost of \$1,000,000, in this city.

MILWAUKEE. - 186 oth, remodeling dwell for club house; cost, \$15,000; o. Calumed Club; a, H C Koch & Co.

18 buildings less than \$7,000.

BUILDING INTELLIGENCE.

HICAGO, ILL.-481-89 N Clark, br addn to stores; cost, \$12,000; o. E Hanecy; a, Flanders & Zimmerman; b, Wm A Barton.

419 25th, br flats; cost, \$12,000; o, Jno Ptacek; a, J F & J P Doerr; b, Goodrich Bros.

849-53 W Monroe, br dwell; cost, \$20,000; F V Newell; a, Sprague & Newell; b, Jas McGraw.

154-56 N Morgan, br flats; cost, \$18,000;

o, C Christiansen; b, C Niesen.

1118-22 Superior, br flats; cost, \$8,000;
o, W. L. Blood; a, E E Snyder; b, A H Earle.

2121 Wentworth av. br flats: cost, \$8,000; C E Robinson; a, E Steude; b, George Schneider.

380-84 Dayton, br dwell; cost, \$12,000; O. C A David; a, J S Woollacott; b, J Woollacott & Son.

28-30 Franklin, 2-story br addn to business block; cost, \$23,000; o, Wm Hill; a, L G Hallberg.

Webster av, nr Jay, br store and flat; cost, \$10,000; o, J Black; a, Ju. H Huber.

34th, nr Michigan av, br and st residence; cost, \$15,000; o, Samuel Leopold; a, Wilson, Marble & Lawson.

Cor Van Buren and California av, br and st store bldg; cost, \$9,000; o, J Sheehan; b, same as above.

42 buildings costing less than \$7,000

P. PAUL.—Another large building will be put up on West Third street by the Phillip Best Brewing Company, of Milwaukee. It will be on the edge of the bluff, five stories P. PAUL high in front, eight in the rear, and will cost

(Continued on page 176.)

PROPOSALS.

(Continued from page viii.)

MI PROVING CANARSIE BAY, NEW YORK.—
Engineer Office, U. S. Army, Room at, Army
urlding, corner Houston and Greene Streets, New
Ork, January 17, 1888. Sealed Proposals for building
Pile Dike at Canarsie Bay, New York, will be relived at this office until twelve (12) o'clock M., Wedsclav, February 15, 1888. Proposals must be made
tr plicate. Specifications, blank forms and instructions to bidders may be had on application at this
fice. G. L. GILLESPIE, Lieut. Colonel of Engiers.

roposals for High Service Pumping-Engine for the Cincinnati. Water Department.

E ALED PROPOSALS will be received at the office of the Board of Public Affairs of the City Cricinnati, until 12 o'clock, noon, of Thursday, be wary 23, 1888.

Their quired capacity of engine will be a delivery ten million (10,000,000) gallons of water per twenty-ir (24) hours from Eden Reservoir into the Mt.

The required capacity of engine will be a delivery ten million (10,000,000) gallons of water per twenty-ir (24) hours from Eden Reservoir into the Mt. ib time service.

By classify the received for engines of either high or interest duty.

By class will be required to furnish from their own and such drawings and specifications with their bids will be necessary for intelligent analysis of the rich substitution of the desired to the first desired to the original formation for bidders in the had at the office of A. G. Moore, Superintendation and Engineer of the Water Department.

By classify the investigation of the control of the surface of the envestages containing their bids.

Facthold must be accompaned by two disinterators titles, and the printed form must be used, as ne other will be received.

The Board reserves the right of accepting or retting any of the bids.

By order of the Board.

THOMAS G. SMITH, President.

W. BROWN, Clerk.

roposals for Steam Boilers for the Cincinati Water Department.

EALED PROPOSALS will be received at the office of the Board of Public Affairs of the city of Cinibati until 12 o'clock, noon, of Thursday, February, 1888, for furnishing and erecting complete, at the ont Street Pumping-Station, an amount of boilerwer equivalent to the evaporation of 36,000 pounds water per hour.

Also separate proposals will be received for furnishg and erecting, at the Hunt Street Pumping-Station, thers sufficient to evaporate 15,000 pounds of water rhour.

ners sufficient to evaporate 15,000 pounds of water rhour.

Bidders will be required to furnish from their own ans such diawings and specifications with their bids will be necessary for intelligent analysis of the variadetails.

General specifications and information for bidders to be had at the office of A. G. Moore, Superintendent of Figureer of the Water Department.

Bidders must indorse their names and address upon eoutside of the eavelope containing their bids.

Each bid must be accompanied by two disinterested reties, and the printed form must be used, as none her will be received.

The Evard reserves the right of accepting or rejectance of the bids.

By or derivities Board,

THOS. G. SMITH, President.

PROPOSALS.

PROPOSALS.

Louisville Water-Works.

TO CONTRACTORS.—Sealed proposals, addressed to the President and Directors of the Louisville Water Co., and endorsed "Proposal for Building Inlet and River Work," will be received at the office of said company, 540 Third Street, Louisville, Ky., until 12 o'clock M., of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders or their representatives. Bidders are required to state in their proposals, under oath, the names and residences of all the parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each proposal submitted, to enclose a certified check in the sum of one thousand (\$1,000) dollars as a forfeit to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filling up of which the price must be stated both in written words and figures. Any bid submitted otherwise will be declared informal and rejected. The person or persons to whom the contract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sureties, and execute the contract withm six days from the date of notification that the work has been awarded to him or them, and in case of failure or neglect so to do he or they will be considered as having abandoned it, and as being in default to the Louisville Water Company to the amount of the check deposited with the proposal as liquidated damages. General plans and detailed drawings, with the specifications, can be examined at the Water Company's office, from 9 A. M. to 9 P. M., until the day the bids are opened. Not less than two bondsmen will be required from the party to whom the contract may be awarded, and the amount of the bond shall be \$5,000, for which sum the bondsmen shall be jountly and severally liable, as a guarantee that the party entering

TO CONTRACTORS.—Scaled proposals, addressed to the President and Directors of the Louisville Water Company, and endorsed "Proposal for building Engine-House and Engines Foundations, will be received at the office of said company, \$49 Third Street, Louisville, Kv., until 12 o'clock m. of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders, or their representatives. B'dders are required to state in their proposals, under oath, the names and residences of all tice parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each proposal submitted, to inclose a certified check in the sum of five thousand (\$5,000) dollars, as a forfeit to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond, on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filing up of which the price must be stated, both in written words and figures. Any bid submitted otherwise will be declard informal and rejected of the remaining the proposals. Singuistic the contract mit be accompany's office, with acceptable bondsmetas where it and cases of failure or neglect so to do, he or they will be considered as having abandoned it, and as being in default to the Louisville Water Company's office, with the proposal, as liquidated damages. General Plans and detailed drawings, with the specifications, can be examined at the Water Company's office, frong a. M. to 5 p. m., until the day the bids are op ned. Not less than four bondsmen will be required from the party to whom the contract may be awarded; and the amount of the check deposited with the proposal, as liquidated damages. General Plans and Getailed drawings, with the specifications, can be examined at the Water Company's office, frong a. M. to 5 p. m., until the day the bids are op ned. Not less than four benefits of the proposals, addressed to the resident man declared from the pa

PROPOSALS.

New York Aqueduct Commissioners. AQUEDUCT COMMISSIONERS' OFFICE,
ROOM 209, STEWART BUILDING, No. 280 HROADWAY,
NEW YORK, February 8, 1888.

NUMBER 1.

BIDS or proposals for furnishing and delivering and laying 48-inch cast-iron pipes and their appurtenances from One Hundred and Thirty-fith Street and Convent Avenue to the proposed gate-house in the Central Park Reservoir, and doing all other work in connection theiewith, necessary to complete Section 16 of the New Croton Aqueduct, as called for in the approved forms of contract and specifications, on file in the office of the Aqueduct Commissioners, will be received at this office, until Wednesday, the 29th day of February, 1888, at 3 o'clock P. M., at which place and hour they will be publicly opened by the Aqueduct Commissioners, and the award of the contract for doing said work and furnishing said materials will be made by said Commissioners as soon thereafter as practicable. Blank forms of said approved contract and the specifications thereof, and bids or proposals and proper envelopes for their enclosure, and form of bonds and also the plans for said work and all other information can be obtained at the above office of the Aqueduct Commissioners on application to the Secretary.

By order of the Aqueduct Commissioners.

JAMES C. SPENCER,

President. TO CONTRACTORS.

JOHN C. SHEBHAN. Secretary.

AQUEDUCT COMMISSIONERS' OFFICE,
ROOM 200 STEWART BUILDING, NO. 280 BROADWAY,
NEW YORK, February 8, 1888.

NUMBER 2.

TO CONTRACTORS.

BIDS or proposals for furnishing and delivering casting iron pipes and special pipe castings, to be used on Section 16 and Section 17 of the New Aqueduct, at such places in the city of New York as may be designated by the Aqueduct Commissioners, and as provided for in the approved form of contract and specifications now on file in the office of the Aqueduct Commissioners, will be received at this office until Wednesday, the 29th day of February, 1888, at 3 o'clock, p. M., at which place and hour they will be publicly opened by the Aqueduct Commissioners, and the award of the contract for doing said work and furnishing said materials will be made by said Commissioners as soon thereafter as practicable.

Blank forms of said approved contract, and the specifications thereof, and bids or proposals, and proper envelopes for their enclosure, and form of bonds, and also the plans for said work, and all other information can be obtained at the above office of the Aqueduct Commissioners on application to the Secretary.

By order of the Aqueduct Commissioners.

JAMES C. SPENCER, President.

Secretary.

AQUEDUCT COMMISSIONERS' OFFICE,
ROOM 209, STEWART BUIL ING, NO. 280 BROADWAY,
NEW YORK, February 8, 1888.

NUMBER 3.

TO CONTRACTORS.

BIDS or proposals for handling and hauling and laying 48-inch cast-iron pipes and their appurtenances from One Hundred and Thirty-fifth Street and Convent Avenue to the proposed gate-house in the Central Park Reservoir, and for doing all other work in connection therewith necessary to complete Section to of the New Croton Aqueduct, as called for in the approved forms of contract and specifications, on file in the office of the Aqueduct Commissioners, will be received at this office, until Wednesday, the 29th day of February, 1888, at 3 o'ciock P.M., at which place and hour they will be publicly opened by the Aqueduct Commissioners, and the award of the contract for doing said work and furnishing said materials will be made by said Commissioners as soon thereafter as practicable. Blank forms of said approved contract, and the specifications thereof, and bids or proposals, and proper envelopes for their enclosures, and form of bonds, and also the plans for said work, and all other information can be obtained at the above office of the Aqueduct Commissioners on application to the Secretary.

By order of the Aqueduct Commissioners.

JAMES C. SPENCER,

President.

Secretary.

Secretary.

Secretary.

6TH OF FEBRUARY, 1888.

SEALED proposals will be received at the office of the Supervising Architect, U.S. Treasury Department, at Washington, D.C., and opened at 2 P. M. of the 21st day of February, 1888, for cutting all the stone and setting the same, etc., for furnishing and laying all the brick required to complete the basement extension of the U.S. Court-House and Post Office at Brooklyn, N.Y., from the concrete footings, to and including the water-table, and for supplying and putting in place, complete, the first tier of iron beams. Each proposal must be accompanied by a certified check in the sum of \$500, made payable to the order of the Treasurer of the United States. The right to reject any bids is reserved. The plans and specifications can be scenat this office, the office of the Superintendent, and at the rooms of the Builders' Exchanges at Albany, N.Y., Philadelphia, Pa., Pittsburgh, Pa., Cleveland, O., and Newark, N. J.; Permaoent Exhibit and Exchange, Chicago, Ill., Virginia Mechanics' Institute, Richmond, Va.; and the Master Builders' Association, Boston, Mass. (Signed) WILL. A. FRERET, Supervising Architect.

ciation, Boston, Mass. (Signed) WILL. A. FRERET, Supervising Architect.

TO BUILDERS.—Office of the Light-House Engineer, Third District, Tompkinsville, N. Y., February 1, 1888. Proposals will be received at this office until 12 o'clock noon of Thursday, the 23d day of February, 1888, for furnishing the materials and labor of all kinds necessary for the construction, completion, and delivery of the Engine-House at Bedloc's Island, New York Harbor, N. Y. The amount available for this work is about \$9,000. Plans, specifications, forms of proposal, and other information may be obtained on application to this office. The right is reserved to reject any or all bids, and to waive any defects. D. P. HEAP, Major of Engineers, U. S. A., Engineer 3d Light-House District.

PROPOSALS.

SEWERS.

SEALED BIDS will be received for construction of sewers in Districts Nos. 1 and 2, until March 1, 1888 Estimated cost, \$30,000. For further information

W. A. WAGNER
City Clerk, Beatrice, Neb.

Proposals for Submerged Pipe.

Proposals for Submerged Pipe.

PROPOSALS are wanted at this office till February 28th, for dredging and laying about 6,000 feet of 18-inch pipe, and 4,000 feet of 8-inch pipe at Marinette Wis. Plans, specifications and profiles will be furnished on application. Address

American Water Works & Guarantee Co., Lim., 12 Pittsburg, Pa.

UNITED STATES ENGINEER OFFICE, P. O.

Box 5,346, Room 124, P. O. Building, Boston,
Mass., January 2, 1888.—Sealed proposals, in triplicate,
will be received at this office until 12 o'clock
noon of February 11, 1888, for the repair of the U. S.
Engineer Steamer "Tourist." For specifications ard
blank forms apply to the undersigned. G. L.
GILLESPIE, Lt.-Col. of Engineers.

GRANITE PAVING BLOCKS. — Proposals are wanted at Boston, Mass., until February 17, fer furnishing 60,000 granite paving blocks to the Park Department. Address the Park Commissioners, 87 Milk Street, Boston, Mass.

BROOKLYN, N. Y.—Sewer construction in the sum of \$70,000 is to be commenced here soon.

WATER-SUPPLY.- Proposals are wanted at Jersey City, N. J., until February 13, for furnishing a pure and wholesome supply of water to Jersey City, water to be supplied into Reservoirs Nos. 2 and 3, on Bergen Hill, Jersey City, and into the high-service system of distribution-pipes of Jersey City, at an effective head in such high-service pipes of 100 feet above high-water level in Reservoirs Nos. 2 and 3, in accordance with the specifications. Address Martin Finck, Clerk, Board of Public Works.

SEWERS.—Proposals are wanted at Albany, N. Y. until February 20, for laying, etc., drains in certain streets. Address Thomas J. Larahan, Clerk, Street Department.

WATER-WORKS.—Proposals for constructing a system of water-works in Falls City, Neb., are advertised for until March r. W. Kiersted, of Pearson & Kiersted, Kansas City, is the Engineer.

CHURCH.—Proposals are wanted at Pittsburg, Pa., until February 13, for erecting an M. F. church at McKees Roeks. Address John U. Barr, architect, 42½ Sixth Street, Pittsburg, Pa.

EI.ECTRIC-LIGHTING.—Proposals are wanted at Fort Plain, N. Y., until February 18, for lighting the public streets, etc., with electricity. Address the President of the Board of Trustees.

HOTEL AND DWELLING.—Proposals are wanted at Whitestone, L. 1, for the erection of a hotel and dwelling. No date specified. Address John Beckman

COURT HOUSE,—Proposals are wanted at Montreal, Can., until February 16, for building extension to court house. Address A. Leveque, 12 Place d'Armes.

BUILDING.—Proposals are wanted at Cincinnati, Ohio, until February 20, for excavation, concreting, foundations, brick work, cut stone work, iron work, copper and slate work, interior concreting, fire-profing, and asphalt, for the crection of a City Hall in this city. Address R. Allison, Chairman Board of City Hall

CHEMICAL ENGINE.—Proposals are wanted at Duluth, Minn., until March 1, for one double-tank chemical fire-extinguisher, 200-gallon capacity Address John K. Shaw, President Board Fire Commis-

PAVING.—Proposals are wanted at Albany, N. Y., until February 20, for paving, curbing, etc., certain streets. Address Thomas J. Lanahan, Clerk Street Department.

STREET RAILWAY.—Proposals are wanted at Syracuse, N. Y., until February 13, for (urnishing materials (except the iron-work and tie.) and constructing the Woodlawn and Butternut Stre-t-Railway, in accordance with the plans and specifications furnished by the said Company. Address Toos, Kaufman & Co., this city.

HOSPITAI. BUILDING.—Proposals are wanted at St. Paul, Minn., until February 13, for the construction of a brick hospital building at Fort Sully, Wash. T. Address A. F. Rockwell, Quartermaster, U. S. Army, Chief Quartermaster.

U. S. Army, Chief Quartermaster.

COPPER TUBING, WIRE ROPE, ETC.—Proposals are wanted at Washington, D. C., until February 20, 161 539 feet drawn copper turing, 265 feet wire rope, 6 barrels W. S. sperm oil, 2,000 bushels chaicoal, 1,500 pounds rough hexagonal nuts, 4 dozen screwwrenches, 200 pounds iron washers, 200 pounds gumpacking, 20 gallons neatsloot oil, 1 roll stencil paper, 500 pounds white chalk, 2 dozen oil-stones, 200 pounds gum-camphor, and 6 pieces (2,380 feet). B. M., Georgia yellow pine, to be delivered at the Navy Yard, Washington, D. C. Address James Fulton, Paymaster-General, U. S. Navy.

PUMPING-ENGINE.—Proposals are wanted at Toledo, O., until March 15, for a pumping-engine of 10,000,000 gallons capacity, and for the sale of two old Worthington engines of 5,000,000 gallons capacity each. Address the Water-Works Superintendent.

I.AYING SUBMARINE PIPE.—Proposals are wanted at Toledo, O., until March 6, for laying a submarine line across the river. Address the Water-Works Superintendent.

STREET WORK.—Proposals are wanted at New York City until February 21 for doing work in certain treets. Address the Department of Public Works.

CLEANING STREETS.—Proposals are wanted at Jersey City, N. J., until February 20, for sweeping and cleaning about 550 miles of paved streets, and the removal of all dirt, rubb sh, garbage, kitchen swill and ashes from all the streets of Jersey City according to specifications. Address Martin Finck, City Clerk.

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BUILDING INTELLIGENCE.

WAUKESHA, WIS .- C E Chase and Andrew Miller will erect a hotel on the site of the present American House, which they will tear down

APPLETON, WIS.—The Odd Fellows will build a 3-story store and office bldg that will cost \$20,000

KANSAS CITY, MO.-N w cor Pendleton and Park av, block 8 bldgs; cost, \$30,000; o. S H Taylor

4th. bet Del and B'way, stable; cost,\$16,-000; a, Wells Fargo Ex.

TOMAHAWK, WIS.—Bradley Bros, of Milwaukee, will build a sash, door, and blind factory here.

GRAND RAPIDS, MICH.—Bridge and Barclay, br block; cost, \$15,000; o, A. B. Knowlson; a, W G Robinson

Ionia st, fr church; cost, \$8,000; o, Fourth Holland Reformed Society; a, S. J. Os-

BROOKLYN, N. Y.—The Building Committee of St. Augustine's Roman Catholic Church has selected the designs of Parfitt Bros., architects, of this city, for their new church, chapel, school house, and parochial residence to be presented on Sixth Avenue. residence, to be erected on Sixth Avenue, between Sterling and Park Places. The entire cost will be \$250,000.

MINNEAPOLIS.—Western av, bet 11th and 12th st, b. store and flat; cost, \$18,000; o, E Anderson.

Shingle Creek, br pump house; cost, \$214,000; o, city of Minneapolis; a, A Rinker.

15th av S, bet 8th and 9th sts, wood dwell; cost, \$7,600; o, a, and b, John Brandt.

Cor 6th av and 9th st S E, 2 wood warehouses; cost, \$8,000; o, Minneapolis Furniture Co.

Colfax av, near 26th st, wood dwell; cost, \$8,000; o, A Dickenson.

Cor 5th av and 24th st E, br stores; cost, \$20,000; o, O C Dahl.

5th st, bet Hennepin and Nicollet avs, br stores; cost, \$10,000; o, C S Brackett & Co.

MADISON, DAK. — Much building is planned for the coming season. Plan six fine residences are already drawn.

GREAT FALLS, MONT .- The Montana Smelting Company has chosen a site near Black Eagle Falls. The works will smelt 200 tons daily.

NEW CORPORATIONS.

THE Chicago Natural Gas and Oil Supply Company; capital stock, \$1,000; incorporators, Louis Leland, Charles Rose, and others.

THE Erie Car Heating Company, at Chicago; capital stock, \$400,000; incorporators. John M. Ormsbee, Pearl D. Hoyt, and others.

THE Chicago Automatic Induction Company; capital stock, \$1,000,000; incorporators, George S. Robertson, James C. Martin, and others.

THE St. Louis Gas Economizer Company, at East St. Louis; capital stock, \$250,000; incorporators, Henry Vogelsang, R. D. Lancaster, and others.

Los Angeles, Cal.-The Alamitos Water Company has been incorporated with a capital stock of \$100,000 to acquire water and water stock of \$100,000 to acquire water and water rights, construct dams, lay pipes and construct water-works to supply the town site of Alamitos and Long Beach and the lands of the Alamitos Rancho with water for domestic and irrigating purposes. The trustees are I. W. Hellman, L. Bixby, and others, with offices of the incorporation in this city.

THE Decatur and Western Railway Company, Decatur, Ill. Capital stock, \$1,215,000. Robert B. R. Pierce, and others, incorpora-

THE Bonner Spring and Kansas City Rapid Transit Railway Company, Kansas City, Mo. Capital stock, \$250,000. D. T. Cornell, and others, incorporators.

THE People's Electric Street Railroad Comdany, Buffalo, N. Y. Capital stock, \$50,000. Peter McNeil, and others, incorporators. THE Wayne Railway Time Signal Company, Fort Plain, N. Y. Capital stock, \$50,000. II. Albert Wayne, and others, incorporators.

THE Petersburg, Va., Fuel, Power & Lighting Company. Capital stock, \$100,000. Incorporators, S. Bolling, R. B. Mahone and others.

THE Hudson, N. Y., Electric Light Company. Capital stock, \$60,000. A. W. Rice, T A Boynton, and others.

THE Lowville, N. Y., Electric Light Company. Capital, \$15,000. John J Moore, and others, incorporators.

THE Bay State Gas Company of New ork. Capital, \$5,000,000. Samuel Little, and others.

THE Iowa Railway Company, Marshalltown, lowa; capital stock, \$18,400,000; Edward H. Perkins, and others, incorporators.

THE Anaheim, Olinda and Pomona Railroad Company, Anaheim, Cal.; capital stock, \$750,000; Edward Records, and others, incorporators.

THE Hornellsville Railroad Company, Hornellsville, N. Y.; capital stock, \$50,000; John W. Curtiss, and others, incorporators.

THE Kansas City, Arkansas and New Orleans Railroad Company, Beede, Ark,; capital stock, \$5,000,000; George M. Barbour, and others, incorporators.

THE St. Paul, Minn., Gaslight Economizer Company. The incorporators are: John C. Han ley, L. N. Denslow, and others.

THE North-western Car Heating and Lighting Company at St. Paul, Minn. Capital stock, \$1,000,000. Incorporators: T. B. stock, \$1,000,000. Incorporators: T. Miller, William M. Klinefetter, and others.

THE Moorhead and Lake Superior Railway THE Moornead and Lake Superior Kanway Company to construct a line of road from Moorhead to some point on Lake Superior. The headquarters will be at Moorhead; the capital stock \$10,000,000. The incorporators are: Thomas C. Kurtz, William H. Davy, and others.

THE Northwestern Modern Car and Steam-Heating Co., located at St. Paul, Minn., with a capital of \$1,000,000. The incorporators are Thomas B. Mills, William M. Klinepetta, and others, of St. Paul.

THE Moorhead and Lake Superior Railway Company, capitalized at \$10,000,000. The object is to construct and operate a railway trom the city of Moorhead in a general easterly direction to some point on Lake Superior, together with such branches and extensions as may be desirable. The place of business shall be at Moorhead, and the incorporators are Thomas C. Kurtz, William H. Davy, and

ABENDROTH & ROOT'S IMPROVED

Water-Tube Steam-Boiler

OUR new boiler has successful demonstrated its superiority by practical use under most trying circumstances. We have confidence, therefore, in our ability to meet the most exacting requirements, and invite a critical examination of our new system of construction by all who contemplate purchasing boilers

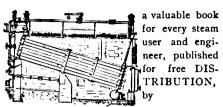
ABENDROTH & ROOT MFG. CO. 28 CLIFF STREET, NEW YORK.

Correspondence solicited.

THE THOMAS GIBSON COMPANY of Cincinnati, O., who were the first importers and manufacturers of sanitary fixtures, have introduced a new closet, The CAR-LISLE PEDESTAL, "front outlet," the distinct ive features of it being SIMPLICITY, PERFEC1 WASH, scientific construction, and moderate cost. A handsome circular and price-list will be furnished ON APPLICATION.

273 Walnut Street. CINCINNATI

"STEAM"



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HAVANA, CUBA, 50 San Ignacio.
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Cabinet Makers and Decorators.

EXCEPTIONAL facilities for the manufacture of fine Architectural Cabinet Wood-Work and Interior Decorative Work from the designs of architects and our own artists.

An inspection of our Warerooms is solicited.

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Reference permitted to the office of this journal.

Steam and Hot Water Heating Apparatus. GILLIS & GEOGHEGAN,

116, 118, 120 & 122 Wooster Street. NEW YORK. THIRTY YEARS' EXPERIENCE.

MANUFACTURERS OF
STEAM AND HOT WATER Warming and Ventilating

Apparatus,

Kansas City, Mo.

EDWARD P. BATES,

59 WEST WATER ST., SYRACUSE, N. Y.

National Hot-Water Heater Co.

191 Fort Hill Square, Boston,

See announcement on page x, issue of February at



Steam-Heating Specialties

Champion Return Stree.
Trap, Eureka Pressure kg
ulator and Back Pressure kg
Vaive.
TIMOTHY KIFLEY.
7, 9, & 11 W. 13th M. N.)
Send for Illustrated Gween

Water Pressure Regulator.

BARTLETT, HAYWARD & CO.

Manufacturers of Hor Water (High and Low Tee perature) Stram (High and Low Pressure) Heave Apparatus, Furnishing Plan, Specifications and Signi intendence for the Heating and Ventilating of Pub.

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Established 1816

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W. H. GREEN, Jr. WM. H. GREEN, Proprietor. VULCAN WORKS.

ORME Sole Manufacturers of the improved ORME
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Office and Store, 34 S. Second St., 1992



GREEN-HOUSES, BATHS, ETC.

Hot-Water Boilers.

JNO. A. SCOLLAY, 74 and 76 Myrtle Ave., Brockha Catalogue sent on applicatus





Heating Ventilating Boilers for Heating Water for Batis HITCHINGS & CO., 243 MERCER STREET, NEW YORK, Send 4 cents postage for Illustrate

THE OSBORNE SYSTEM OF STEAM HEATING is based upon scientific prin ciples carefully worked out and reduced to practice, having been in use for the last seven years; in short, it is an ideal system of steam-heating, adapted for use in all large buildings requiring steam heat. It is from 15 to 20 per cent. more efficient than the Gravity System, and from 30 to 40 per cent. more efficient than any of the Expansion or High-Pressure Systems using traps and open tanks.

For further information apply to

E. F. OSBORNE & CO...

ST. PAUL, MINN.

Established 1855.

CRANE BROS. MANF'G. COMPANY,

General Offices; CHICAGO, ILL,

Manufacturers of

Cast Iron and Malleable Iron Fittings

BRANCHES: Omaha, Neb.

Los Angeles, Cal.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE GRANT MONUMENT COMPETI-TION.

THE Executive Committee of the Grant Monment Association issued a note some ten months ago inviting designers to send for a circular embodying the conditions and provisions under which the above competition would take place. Upon application it was stated that "the terms of the circular were not quite decided upon, the committee being desirous to issue a circular whose conditions should be of the best and most satisfactory character," that "expert advice was being taken as to the best method to be adopted,"

Under date January 26, 1888, this circular, which has been nearly a year in preparation, is issued, with the time for receiving designs extended from March 1 to November 1, 1888.

It would be supposed that the terms of a competition upon which this much thought-as measured by time-had been employed, upon which expert advice had been taken, with the excellent and successful precedent of the Indiana State monument competition—just decided and for a work of such importance, would be above reproach. Such, unfortunately, is not the case.

The competition is an open one, and as such is perfectly fair and right, the usual methods for preserving the incognito of the designers being adopted, but the provisions covering the methods by which the design is to be shown are to be criticised.

Section 6 of the circular says:

"All the drawings are to be made in lines with India ink and the drawing pen, or simply shaded in India ink."

While from section 8:

"To aid in illustrating any figure or bas-relief shown in a design, models of such, made with plain, untinted plaster of Paris, may accompany any design. These to be to a scale of one inch to one foot. Competitors may also, at their option, submit similar plaster models of the entire structure at a scale of one-quarter of an inch.

Here are three separate styles in which designs may be shown, and to one who is familiar with the great difference in appearance between an outline pen-and-ink drawing and a plaster model of the same design, it is apparent that this is a most mistaken and faulty provision.

The circular further states that five designs considered the best and most meritorious will be selected, and to these premiums will be paid, ranging from \$1,500 to the first to \$200 to the fifth, "whereupon the said designs shall become the absolute property of the association.' premiums are probably as liberal as could be expected, but the provision taking away the property right in all the premiated designs is quite indefensible. The committee wish to erect one monument, not five, and the premium for any design not adopted should be a bonus and not a price.

Again, the committee do not bind themselves to employ the author of the first prize design to carry out the work, but, as the design is their property, they are quite at liberty to amend it, to add to it, to combine it with the other four and turn the completed masterpiece over to some granite company to execute.

The last and the condition which merits the most severe criticism is Sec. 17:

"Each competitor shall state in the letter accompanying Proposals his design what further remuneration he would expect for

furnishing all details and superintending the work should his design be adopted and the committee choose to em

One can conceive the scramble that this will cause, the cutting of rates, the patriotic one-percent. offers, and the consequent suffering among contractors when the one-per-cent. man builds his one-per-cent, design.

. This committee have been somewhat criticised in the public press for some time, and this last . would seem to show that they deserve it. Let their object be not, How much can we get for the least money? but, How can we get the

IMPROVEMENT OF THE CANALS OF NEW YORK.

STATE SENATOR CANTOR has introduced a bill "To facilitate State commerce by increasing the lockage capacity of the Erie and Oswego canals, and to improve the Erie, Oswego, Black River, Champlain, and Cayuga and Seneca Canals," which provides for the appropriation of \$1,000,000 to be expended in doubling the length of at least fourteen locks on the Erie Canal and of two locks on the Oswego Canal; in deepening the Erie Canal by dredging one foot from the bottom, where it can be done without interfering with permanent structures, and by raising the banks one foot, which will increase the present standard depth from seven feet to nine; in deepening or bottoming out the other canals men-tioned, and in furnishing machinery for the locks. The total expense of these improvements are

said to be estimated at \$5,000,000, and as boats are now towed in pairs, tandem, the lengthening of the locks will greatly expedite their passage, while increasing the depth will allow fuller loads with less tractive power.

From the completion of the enlargement of the Erie Canal, commenced in 1836, until last year, when the lengthening of the locks was commenced tentatively, nothing has been done by the State to cheapen transportation by enlarging the Erie Canal. Although the impetus given to New York City by the canal before the fall in railroad freight charges commenced has kept her, as it made her, the principal commercial emporium of our country, her commercial growth has undoubtedly been much slower than if the capacity of the canal and the boats employed on it had kept pace with the improvements in the railroads and their equipments.

From 1862, the date of the completion of the enlargement, the average canal-boat load has not been increased; at times, from obstructions in the canal, it has decreased. But by doubling and quadrupling tracks, by building new roads, and by improvements in engines, cars and roadbed, the carrying capacity of our railroads has been immensely increased, while their freight charges have been reduced to about one-fourth of what they were twenty years ago. During this time the quantity of grain exported from Montreal, Boston, Philadelphia and Baltimore has increased in much greater ratio than the grain exports from New York City.

These considerations would seen convincing in favor of enlarging the canals, the only question being: Is the proposed enlargement sufficient? Mr. Sweet, while State Engineer, read a paper before the American Society of Civil Engineers proposing a radical enlargement of the Erie Canal, so that lake vesradical

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sels could continue their voyage from Duluth or Chicago to this city. The elevator interests in Buffalo have, with the railroads, so far prevented any direct action by the State on this suggestion, so that not even a survey showing the probable cost of such an enlargement has been made. But the proposition has undoubtedly been influential in leading to the bill introduced by Senator Cantor, and interests which would have been glad to have the canal remain in its present state may possibly urge this bill forward to prevent an enlargement which would still further cheapen freights.

While any real improvement of the canal is to be welcomed, it would seem unwise to spend any large amount of money on work that may be superseded by, if, indeed, it be not in the way of, more radical improvements later on. It would certainly be the part of wisdom, before any further steps are taken, to formulate a comprehensive plan that shall provide for the final enlarge-

and lakes, and thus to provide pure water for our crowded and increasing cities.

"This matter is now being brought more prominently into public notice from the agitation of the question of a supply of pure and wholesome water for the cities of Newark and Jersey City, and my attention has been officially called to the avowed intention and effort of parties to control, so far as it may be possible, by purchase of water rights, the water-shed which may in the future become necessary, not only for the comfort, but for the health and prosperity of the people of this State. The claim is already made, by different parties, that they have secured water rights by purchase, to which the interests of the State are subservient, and which render the use, by our rapidly increasing populous cities, of the natural supply of pure water, which a beneficent Providence has freely given to one section of our State, impossible except by purchase from them. If this claim be well founded, it is high time that the people took steps to secure whatever interest they may now need, and whatever rights they may hereafter require.

missing a passing horse car filled with passengers.

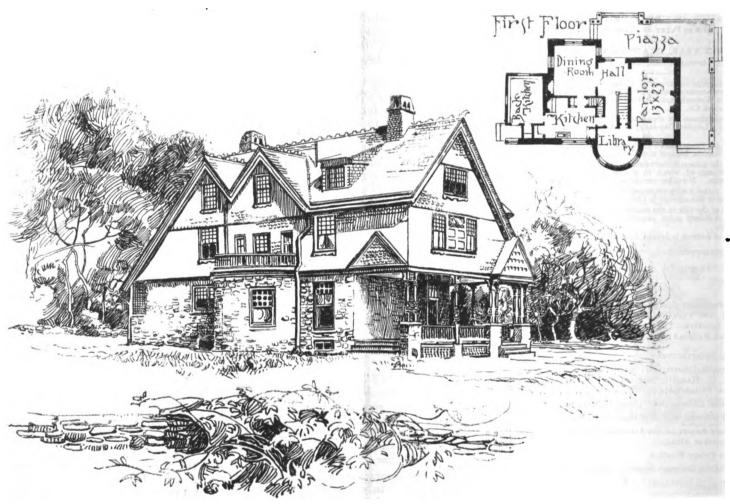
This week another contractor for the same company has had a similar accident on Broadway, but this time it did not miss the car, and four dead and many wounded are the consequence.

The accident is described on another page, but one of its lessons we would like to enforce here.

It is briefly this:

Such operations in crowded streets should not be left to the sole care of mere riggers, however careful or skillful. Both these accidents, apparently, occurred from ignorance on the part of the men in charge as to what strains half-finished structures could safely bear, and not from any deficiency in the materials or methods employed to handle the weights they had to lift

The obvious remedy is to have a competent engineer in immediate charge of such work, or



A HOUSE NEAR PHILADELPHIA. --- AMOS J. BOYDEN, ARCHITECT.

ment of the canal to its utmost useful capacity, so that all work done hereafter may be in harmony with that purpose and subordinate to its ultimate and systematic accomplishment.

SELLING RAMAPO WATER TO NEW YORK AND BROOKLYN.

In view of the proposal of certain parties to sell water to New York and Brooklyn, to be conveyed thither from the Ramapo region through the State of New Jersey, and thence by pipes through a tunnel under the Hudson River, the following reference to the matter by Governor Green, of New Jersey, in his recent message to the Legislature, is of interest, as indicating that the State of New Jersey expects to be consulted before such a proposal could be carried out:

"Much attention has been given by the State Board of Health, during the past year, to the water-supply of the State. It is time that some efficient legislation was had to secure to our citizens the benefits of mountain streams "In 1882 a State Board of Water-Supply was created. It entered upon its work. The next year its field of operations was extended. The reports are able and instructive and are the result of careful examination and investigation. Among other duties they are required to keep the Attorney-General advised of any attempts to interfere with the rights of the State, and their work in this direction has been faithfully done and attended, it is believed, with good results. An appropriation to defray the expenses of the board was made in 1883, but it was limited to two years and has expired by its own limitation. I would recommend that an appropriation be made to meet the necessary expenses of the board as provided for in former acts."

THE FALL OF A HOISTING-ENGINE ON AN ELEVATED RAILROAD IN BROOKLYN.

IT will be remembered that last fall a traveling derrick used in erecting the structure of the Union Elevated Railroad, on Flatbush Avenue, Brooklyn, fell to the ground, barely

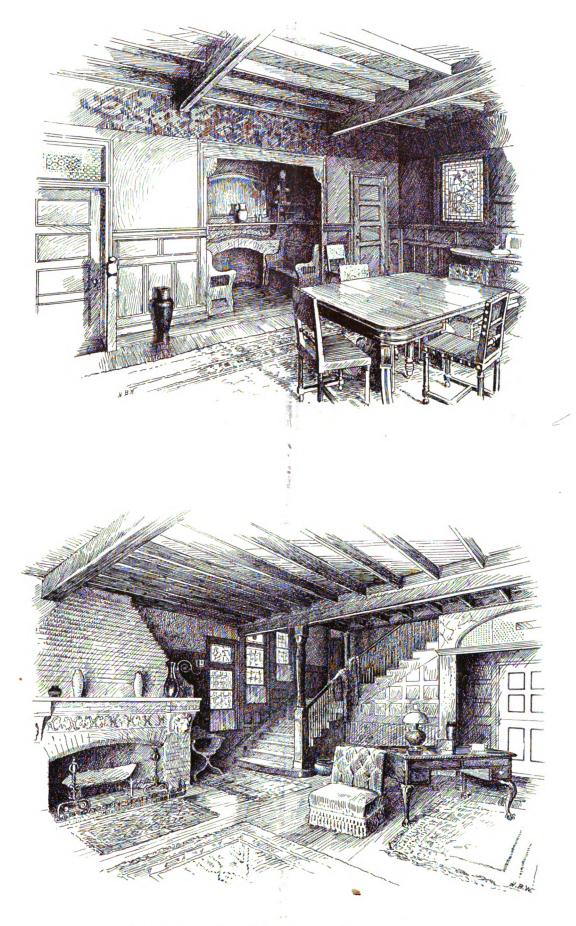
at least he should have such oversight as to see that the unbraced structure is not subjected to dangerous strains. In both cases the delay in bracing the longitudinal girders seems to have largely contributed to the accident, and such a source of danger should not be longer tolerated merely for the convenience of the contractor.

Whether the engineering superintendence of such work should be provided by the contractor, the company, or the city we shall not now discuss. It is the duty of the city to protect the lives and property of its citizens, and it should either exercise such oversight itself or compel those to do so to whom, for their own advantage, it has granted the use of its streets.

OUR ARCHITECTURAL ILLUSTRATIONS.
INTERIOR IN RESIDENCE OF MR. GEORGE C. HAMMILL,
SARATOGA SPRINGS, N. Y.—H. LANGFORD
WARREN, ARCHITECT.

A HOUSE NEAR PHILADELPHIA.—AMOS J. BOYDEN-ARCHITECT.





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

INTERIOR, RESIDENCE OF GEORGE C. HAMMILL, ESQ., SARATOGA SPRINGS, N. Y.

H. LANGFORD WARREN, ARCHITECT.



COTTAGE HOSPITAL CONSTRUCTION. BY HENRY C. BURDETT,

Chairman of the Executive Committee of the Hospital Association.

Author of "Cottage Hospitals," "Pay Hospitals of the World," etc.

Some two years ago I drew attention in the Lancet to several new cottage hospitals designed upon the pavilion principle on the lines laid down in the second edition of my book on "Cottage Hospitals," where the plan of a model hospital for fifty beds constructed upon this plan is given. I unfortunately omitted to caution the inexperienced that the pavilion system is too costly to be extended to hospitals having less than fifty beds, and as a matter of fact, several of the more recent cottage hospitals demonstrate this fact beyond all question. The importance of economy in cottage hospital construction is generally admitted, and at the request of correspondents in England and America, of architects and hospital authorities, I am induced to ask you to allow me to suggest some alternative plans based upon an exceptional experience combined with a careful consideration of the faults apparent in several of the more ambitious cottage hospitals which have been erected during recent years. The ends to be kept in view in building a cottage hospital are: (1) Economy in administration; (2) convenience of intercommunication between every portion of the building, so that the nurses, matron, and her assistants may be saved as much labor as possible; and (3) in cases where the population is increasing, facilities for extension, should occasion arise for increasing the hospital accommodation. All these points have been considered, and I am of opinion that the plan which seems preferable to the pavilion for small cottage hospitals is one designed upon the straight model. Such a plan enables the architect to arrange all the wards upon the ground floor and to provide perfect ventilation. The matron's and nurses' rooms and the bath and operating rooms can also be placed on the same floor, whilst the kitchen, with sleeping accommodation for the staff, can be located upstairs. A lift communicating with the kitchen and ground floor should be provided. The complete isolation of the kitchen when necessary, and the avoidance of many evils which might otherwise arise, may be secured by the erection of a special staircase connecting the outside and back portion of the premises with the kitchen, by which access could always be obtained to the latter without entering the hospital. Such a plan affords the widest scope for future extension, should they be necessary at any time. Some people have a strong prejudice in favor of keeping the sexes apart by placing the female wards on the first floor. They also prefer a two-story building, on the ground that it is less pretentious and more homelike and comfortable than any other which can be devised. I have endeavored to meet the views of such persons in plan No. 3, and I have been induced to give such a plan with the object of showing that, although the building occupies less ground, and would, therefore, at first sight be thought to entail a less expenditure, in practice it will be found that this form of building is as costly as the other.

The plans have been prepared for me by my architects, Messrs. Young & Hall, who have made hospital and asylum construction a special study. I find that whoever desires to secure a cottage hospital for a particular locality is in.pressed with the feeling, and I think rightly so pressed, that the elevation of the building, however plain, should at least be attractive and stirking. I therefore commence my series of plans by giving the elevation of ground plan No. 2, in order to show that the straight model is not unsightly, but the contrary, as will be seen from the following sketch:

The chief feature in the first design is the entire separation of the administrative portion of the building from ward block, the two being connected by a covered y. The advantage of this plan is that the ward or ds, and the administrative block can be placed in any ition on the site, and in relation to each other. It most effectually separates the quarters of the rest of taff from the ward atmosphere. For these reasons the lan is commended to the consideration of local sanitary authorities and others who have to maintain infection hospitals where the population is comparatively sm I There is no reason why the new blocks on this should not be indefinitely extended to meet the requirements of special localities, and at a comparatively

sma 11

cost.

ADMINISTRATION BLOCK.

Here will be found the day-room and kitchen directly communicating, with a covered way, and adjacent to it a scullery, larder, coals, etc. On the left of the entrance is the matron's sitting-room, the staircase, with the operation-room beyond, and opposite it the rooms for linen and stores. Upstairs are provided five bedrooms for the matron and staff.

WARD BLOCK.

This is self-contained and is arranged to provide accommodations for five male and five female patients. Each ward has a disconnected lavatory, sink, and water-closet, with a separate linen closet and other conveniences. There is also a nurses' room and a bath-room, both of which are placed in the centre, so as to be easily available for both wards. An abundance of cubic and floor space

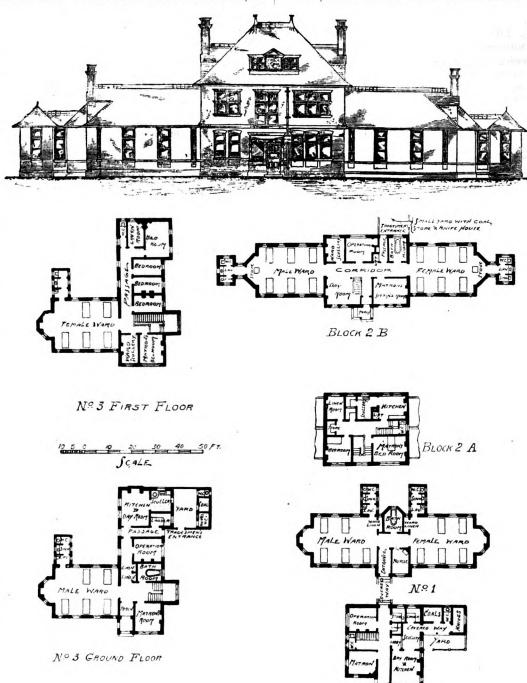
secure complete separation between the tradesmen's lobby and the communication with the wards. A speaking-tube on the ward side of the lift would insure ready communication between the kitchen and ground floor.

ADMINISTRATION.

This is placed in the centre of the building and consists, on the first floor, with the exception of the matron's sitting-room, of a kitchen, with scullery, stores, and laundry, the former of which is connected with the wards and tradesmen's entrance by a lift, as before described. A linen-room, with the nurses' and matron's bedrooms, and store-closets are provided, while sleeping accommodations for the servants and two nurses, if necessary, will be found on the third story.

WARD BLOCK.

This provides accommodation for twelve beds in two



is provided, and each ward would present an unusually cheerful and airy appearance.

PROBABLE COST OF PLAN NO. I, EXCLUSIVE OF SITE.

The building, as shown in the plan, cubes up at 6d. to
£2,010, but in country districts it ought to be possible
to erect such a building for about £1,500, exclusive of
the cost of furniture.

NO. 2, THE STRAIGHT MODEL PLAN.

In this plan the kitchen is placed on the top floor, and, in order to obviate the necessity for tradesmen's boys and men entering the hospital, a lift is placed in a central position which serves equally well for carrying up stores to the kitchen and for sending down meals to the wards. This lift is accessible on the ground floor both to the ward corridors and to the tradesmen's entrance. It will be observed, however, that the plan is so designed as to

wards of six beds each. These wards provide ample accommodation and are entirely disconnected from the offices by a cross-ventilated lobby. In cases where it is probable that an extension of the building may be found necessary, the lavatories, etc., might be placed at the side, behind and at one end of the wards, as shown in Plan 3. This might entail the sacrifice of one bed, but would enable the beds to be doubled at the smallest possible outlay. In those places where more accommodation is not likely to be wanted we should strongly advise the adoption of the arrangement shown on the plan. A spacious dayroom is placed at the left of the entrance, which is thrown open to the corridor on the model of the Halstead Cottage Hospital, where this arrangement has proved in practice a success. A ward scullery, an operating-room, and a bath-room are also provided. Glass doors are placed on



the right of the entrance lobby, shutting off the corridor communicating with the female ward from the day-room and mess corridor. This plan, cubed out at 6d., would cost £1,778, or less than £150 a bed, although it is replete with every modern appliance and would in practice be found to leave little, if anything, to be desired.

No. 3 -THE VILLA HOSPITAL PLAN.

In this plan the kitchen offices are on the ground floor, a point of some importance being a passage which separates them from the rest of the hospital. This passage is ventilated at each end and would certainly tend to prevent any smell of cooking from penetrating to the front part of the building.

GROUND FLOOR.

This provides accommodation for five beds in the male ward situated on the left of the entrance, the scullery and offices being disconnected from the wards and placed outside the building. The matron's room is situated on the right of the entrance, next to it being the staircase; then the bath-room, having the linen-closet in front, and an operating-room with large window at the back. Beyond, again, but disconnected from the patients' portion by the passage already referred to, are the kitchen or day-room, with the usual offices.

FIRST-FLOOR PLAN.

This contains a female ward for five beds, similar to the male ward, with matron's bedroom, ward scullery, four other bedrooms, one of which might be used for isolating a special case, a linen-room, etc. I do not like this plan half so well as No. 2, and I have only given it for reasons already stated. It cubes up at 6d. to £1,988, but in some parts of the country such a building might be carried out at 41/2d. to 5d., which would bring the cost down to £1,500, exclusive of furniture.

GENERAL REMARKS.

Such are the three plans upon which a cottage hospital, complete in all particulars, may be erected and maintained at the smallest cost. No. I plan is specially adapted for infectious cases. No. 2 is undoubtedly the best for small cottage hospitals, because the original cost, as well as the cost of administration, would here be reduced to a minimum. I am often asked how to estimate the cost per head of erecting buildings of this character. Heretofore the pavilion principle has been so generally adopted that the original outlay on cottage hospitals has proved enormous, and the working expenses afterwards are often in consequence so great as to dishearten the supporters of these institutions. The hospitals at Stratford-on-Avon, at Darlington, and at Spalding are especially notable instances of this, and the plans are worthy of study for this reason. It will be observed that the smallest of the three hospitals for which plans are here given contains ten beds. I am disposed to think that accommodation for any smaller number may best be provided in an ordinary cottage. Mr. Charles Ayres, architect for the Watford District Cottage Hospital, containing nine beds, has produced a plan so compact and complete as to make it worthy of study. The building is of one story, and the beds are placed in two wards of four beds each, with an isolation ward for one bed. The lavatories are disconnected from the wards, and operation and bath-rooms are added. The kitchen is cut off from the main building by a disconnecting passage, and the whole plan leaves little to be desired. I have ascertained that the total cost of the buildings was, however, quite £1,800, making the cost per bed over £200, whilst the furniture (£221) and instruments (£31) cost £250 and the site £550.

THE PROPOSED NATIONAL BUREAU OF HARBORS AND WATERWAYS.

In publishing the following letters we desire to state that we shall be glad to give a reasonable space for a discussion of the proposed bill which was printed in our issue of January 28 and the general questions with which it seeks to deal.

KEY WEST, FLA, February 2, 1888.

SIR: The bill recently introduced by Senator Cullom for establishing a corps of United States Civil Engineers, to be charged with the construction and management of the river and harbor works of the United States, a copy of which you have sent me with a request for my opinion upon it, appears to me to be an exceedingly wise measure.

It provides, briefly, for the establishment of a Corps of

Engineers, the membership of which is thrown open to the competition of all the engineers of the United States, while at the same time retaining the skilled services of a part of the corps of engineers in whose exclusive charge these works have been for more than half a century; and it provides also for a system of appointment, promotion, and retirement which, if enacted, must, by relieving the mempressure of political influences, secure to the country the best results of independent engineering skill and judgment.

Since 1826 the management of the river and harbor

improvements of the country has been in the hands of the improvements of the country has been in the hands of the Corps of Engineers of the Army, aided by as many civil engineers employed for the purpose, as occasion demanded. At first the improvements ordered by Congress were not many, nor very extensive, but within the last quarter of a century these have grown enormously, and what is commonly known as the River and Harbor Bill, which has became one of the regular appropriation bills, now provides annually for hundreds, if not thousands, of improvements, involving the expenditure of many milimprovements, involving the expenditure of many millions of dollars. And all these works are managed by a part of the Corps of Engineers, numbering 109 officers, whose services are supplemented by those of 200 or 300 civil engineers, the number depending upon the amount of the annual appropriations.

The faults of this system are apparent. Each and every officer of the Corps of Engineers has too many duties to attend to, and the civil engineers employed, who are as capable and efficient as any in the land, have little or no capable and efficient as any in the land, have little or no prospect of advancement, and though they may remain in the service until they attain to old age, they can never feel sure of retaining their positions however, valuable their services may be, but are liable to lose them at any time through the failure of the appropriations or the change of an officer in charge of the work. With all this the service has been excellent, and no body of trained engineers in the world, can show as the result of their labors greater. the world can show as the result of their labors greater successes or fewer failures than the Corps of Engineers of the army and the civil engineers who have served with

The work is increasing, however, so rapidly, that some different provision for its management must soon be made. Very few of our own citizens, probably, realize how very large our land is compared with the historic countries of the world. When we reflect that the single State of Texas is greater in area than either of the empires of Germany or Austria, or the Republic of France, and that her waterways exceed in length the waterways of either of those countries, it is manifest that we ought to have for the improvement of the waterways of the United States at least as many engineers as either of those countries employs; and, if my memory does not mislead me, France alone has five or six hundred engineers in charge of her internal improvements, whose lives are devoted to her service, and whose services, encouraged and fostered by the State, have made her engineers famous throughout the

The time has come when a broader and better organization of the engineering forces which manage our public works should be attempted, and it is my belief that the system proposed in Senator Cullom's bill is one which in its results would be invaluable to the country, and which engineers of every rank and class throughout the land can unite in supporting. Very truly yours,
WALTER MCFARLAND,

Lieut, Col. of Engineers, U. S. Army.

CHICAGO, January 31, 1888. SIR: I am glad that you have published in your paper the bill lately introduced in the House of Representatives for the reorganization of the river and harbor works of the Government. This bill, as you must have seen by your examination of it, is not hastily or crudely drawn. It is the result of several years' study, deliberation, and con-ference on this subject with Members of Congress who are interested in the subject with Members of Congress who are interested in the subject and among the engineers who constitute the council of the engineering society on national public works, particularly among the members of the executive board of that council, who have had several meetings within the last two years and have, within the last few months, given special attention to this subject. In fact, in order that a proper bill might be formulated, we meet in Weshington and thore had large accounted, we met in Washington and there had a long conference, lasting two days, with Hon. C. R. Breckenridge, who introduced the bill in the House, and by appointment we called upon the President and had a long conference with him. The bill was then drawn up by Mr. Breckenridge and was The bill was then drawn up by Mr. Breckenridge and was sent to us here for examination and revision. We spent several days upon it making some necessary changes in it, and the bill as now printed by you is the result of this work we have given to it. We have endeavored to present a measure to Congress that will tend to purify the river and harbor legislation and to improve greatly the administration of national public works, so far as they relate to rivers and harbors. None of us connected with this subject have any personal aims in view nor any personal benefits to secure. We have been led by a patriotic desire, and not merely by professional purpose, to bring this matter forward to its present status. We have given a great deal of time and considerable money in the way of expenses and work to it, and we now, through your journal and other engineering papers, call upon the engineering and other engineering papers, call upon the engineering profession to come to our assistance and to take hold of this matter in earnest, not only in disseminating the correct views on the subject, but also to bring what influence you can (and it is large) upon Congress so that this bill, perhaps considerably modified, if discussion in Congress shows any changes to be necessary, will pass this session and become a law so that next year the whole subject may be taken up on a broader basis and a better system.

We believe, and have some evidence on which to found this belief, that the U. S. Engineer Corps will not oppose it after they fully understand it. We believe it will be for their benefit as well as for the civil engineering professi have a law enacted under which a better system and a ril one can be employed.

Yours truly civil one can be employed.

E. L. CORTHELL.

THE PRELIMINARY REPORT ON THE ASSEMBLY CHAMBER CEILING IN THE CAPITOL AT ALBANY.

ALBANY, February 3, 1888.

To the Honorable the Speaker of the Assembly:

SIR: The undersigned, having received notice upon February 1, 1888, of their appointment as a commission to examine "the Assembly chamber in the new Capitol, and particularly the ceiling and foundations and supports thereof, for the purpose of ascertaining its present condition and stability, and the danger, if any, to be apprehended therefrom," immediately began work by examining the drawings of the Assembly chamber furnished us We began an examination of the ceiling of the chamber

which has revealed such a dangerous condit on of thing that we are compelled at once to report to the Legislature upon the pressing and immediate question of danger. We went up to the top of the ceiling of the chamber and found that there had been many serious movements of the stones of the groin-vaults, owing to the vaults and ribs not acting together. This caused cracks at the points in some cases of considerable length. In one place, at the apex of the ceiling, the Assembly floor can be seen through the crack. We found that the main vault, certainly in two places, had settled away about (3) three inches below its original level.

All the main ribs which support the central vault were found to be crushed and shattered near the circular keystone. In one of the ribs we found a stone three feet long which was split from end to end in strips. By the side of a stone of another rib was found a spall split from the ribs by excessive pressure; this spall was ten and a half inches long and seven inches wide and three and a half inches thick; it was a perfectly strong and sound piece of stone, and its being split off was due to no defect in the material. On the other side of the same rib another stone had spalled off, leaving the width of the rib at the upper surface reduced from this ten inches to another stone had spalled off, leaving the width of the rib at the upper surface reduced from thirteen inches to six inches in width. Evidences of this fracture extend further up the rib. Here was clear evidence of a piece of sound sandstone split by a pressure of probably many times what it had been calculated to sustain.

We have mentioned these two or three strong instances.

We have mentioned these two or three strong instances but we may say that the whole ceiling is in the same dangerous condition—all more or less cracked—and showing signs of unexpected pressure. As the original size of the ribs was none too large to resist the pressure, it will be clear, in their constantly reducing condition, they are less and love able to do their work. and less able to do their work.

A time must come, and that, we believe, very soon and without warning, when one or more of these overtaxed rib-stones must give way. When that happens the whole ceiling will fall.

We recommend that the Assembly chamber and the rooms in the story beneath be immediately vacate

That steps be at once taken to put up strong and properly supported centres.

That the whole ceiling be taken down as soon as pos

sible, and such steps taken as will relieve the pressure on the walls and supports. There are many other questions connected with the inquiry which we have had no time to examine and will

report upon hereafter.

The imperative necessity of reporting at once upon a question of danger has caused us to postpone everything

JOHN BOGART, State Engineer and Surveyor; THOMAS. CLARKE, Civil Engineer; RICHARD M. UPJOHN.

BRICK-LAYING IN FROSTY WEATHER.

OUR London correspondent writes: "Builders, and others whose building operations are interfered with by frosty weather, may find it worth while to study a report just issued by the Foreign Office, on the question of bricklaying during frosty weather in Norway. The advent of frost in that country, whatever its intensity, does not interfere with building. The secret is in the addition to the mortar used of various proportions of unslaked lime. The mortar is made in small quantities immediately before using. The lime developing warmth, it is necessary to use the mortar quickly, to enable it to set before it cools: the proportion of lime must, therefore, be increased as the temperature falls. The bricks used must not have been exposed to frost or rain, but kept under cover."

Lime is sometimes mixed with cement-mortar for a similar purpose in this country, but is believed to some what reduce the strength of the mortar, and we should prefer to use salt as described in our issue of November 19. r887. We should be glad to hear from any of our readers that have had experience with either method, especially if they have had tensile tests made of the mortar.—ED.]



HENLEY-ON-THAMES SEWERAGE SYSTEM.

(From our London Correspondent.)

THE authorities of this town having received an intimation some time since that they would have to provide some other arrangement of sewerage in place of that existing, whereby the town drained into the Thames, decided to adopt the Shone hydro-pneumatic sewerage system. The works were completed early last year, and after some months' trial were formally opened in October.

The area of the district dealt with is about 175 acres, and the total population at present is about 4,000. The works are, however, calculated for 6,000, allowing 30 gallons per head, or 180,000 gallons per diem. It is estimated by the engineer that one-half of this quantity of the sewage will come to the ejector stations in 400 minutes, or that the maximum flow is 225 gallons per minute. There are no manufactories to take into account, except a few breweries, but in this connection it may be added that a great quantity of large bungs come through without interrupting the working of the valves of the ejectors. The old system of sewers, gravitating to the Thames, is used for the surface water, which is not passed into the Shone system.

The plan shows the division of the town into four districts, each district having an ejector station at its lowest point (marked I. to IV. on plan). The sewage runs to these several ejectors by gravitating sewers of stoneware pipe, seven inches in diameter. Being expelled from the ejectors by compressed air, the sewage passes into a castiron sealed main of five inches diameter. This main, running along along Reading Road and Bell Street, between the ejector stations marked I. and IV., and receiving in its course the tributaries from stations II. and III., is gradually increased to eight inches diameter at Station IV. It is continued thence of the same diameter to the intermediate Station V. (containing three ejectors), whence the sewage is lifted through a pipe of the same diameter to the settling tanks in Lambridge Woods. House connections are 5-inch diameter. Stations I. to IV. contain each two ejectors, and Station V., as previously stated, contains three, all arranged to work independently. The capacity of each ejector is 150 gallons. They are designed to discharge the volume of their contents once a minute. The settling tanks, of which there are two, working independently, each of a capacity of 24,600 gallons, are situated in the woods about a mile and a half from the town ejectors (I. to IV.). The total lift from the town ejectors to the intermediate station (V.) is 52 feet, thence to the settling tank 77 feet. No chemicals are used in precipitating the sewage. A system of "locks" is provided whereby the effluent from the tanks can be run over any desired portion of a large piece of adjacent ground specially prepared for that purpose. The solid matter is readily purchased by farmers in the neighborhood. The total cost of the installation, including legal and preliminary professional charges, purchase and preparation of the land at the outfall for irrigation purposes, etc., etc., was £18,000 (\$86,400). Mr. Isaac Shone, of Wrexham and Victoria Street, London, was the engineer; Messrs. Hughes & Lancaster, of Chester, the contractors for the ejectors, and Messrs. Pratchitt, of Carlisle, the contractors for the general work and the compressing engineers.

AIR COMPRESSORS FOR HENLEY-ON-THAMES.

The compressed air required for raising the sewage of the town of Henley-on-Thames is supplied by two sets of air-compressing engines, each of which is able to supply the whole quantity required while the other is in reserve. The general arrangement of these engines will be readily understood by a reference to the drawings, of which Fig. 1 is a plan and Fig. 2 is a sectional elevation. Figure 3 is a transverse section.

The maximum work per minute consists in lifting 225 gallons to a total height of 180 feet, including friction, or, as this is done in two lifts, it is equal to lifting 450 gallons per minute to a height of 90 feet.

The compressors can deliver per minute a quantity of 290 cubic feet of free air compressed to 39 pounds, the compressing cylinders being 14 inches in diameter, with 21-inch stroke.

The compressor has two single-acting cylinders arranged vertically, so that one delivery-valve is at the top and one at the bottom. The delivery-valve forms at the same time the cylinder-head, and as it lifts when the piston approaches it, no clearance space is required and the whole quantity of air taken into the cylinder can be expelled at each stroke. The inlet-valves are carried in the piston and

HENLEY ON THAMES SEWERAGE PLAN. SECTION HENLEY SEWERAGE SHONE HYDRO-PNEUMATIC SYSTEM SHONE & AULTS PATENT AIR COMPRESSOR. Bullowa Mecono Fig 1.

the two valves are connected together by a rod, so that the one is closed when the other opens. This action is assisted by a friction-clutch gripping the valve-rod.

Each set of compressors is driven by a horizontal compound condensing steam-engine. The high-pressure steam cylinder is 11 inches in diameter. The low-pressure steam cylinder is 19 inches in diameter, each having 18-inch stroke. Both cylinders are steam jacketed and fitted with variable expansion gear.

The engine and air-compressors are mounted on a substantial bed-plate. The plummer-blocks that carry the crank-shaft have bearings that can be adjusted in a horizontal as well as in a vertical direction. The air-pump is 10 inches in diameter, with 6-inch stroke, and is driven from the crank-shaft by manne of a balt.

The engine is provided with a governor to prevent the speed getting above 90 revolutions per minute, and it has also an air-pressure regulator by means of which the steam-

supply is throttled when the air-pressure is above the standard pressure of 30 pounds per square inch.

This regulator is shown in detail in Figs. 4 and 5. The air-pressure acts on a piston and compresses a spiral spring. The motion of this piston is transmitted through multiplying levers to an equilibrium bell-valve by which the steam is shut off when the pressure is too high.

The efficiency of the air-compressor has been tested by counting the number of revolutions and noting the increase of pressure when filling the empty receiver and airmain, and then comparing their capacity with the theoretical volume found by multiplying the piston displacement per stroke by the number of revolutions. The difference has been found in a number of trials to be five per cent.

The engines work with a steam-pressure of 60 pounds per square inch, with a cut-off in both cylinders $= \frac{1}{10}$ of the stroke. They use about $2\frac{1}{2}$ pounds of coal per I. H. P. per hour when developing 35 I. H. P.

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STEAM-HEATING IN WASHINGTON VERSITY.* UNI-

PREVIOUS to 1879 the buildings of Washington University were heated by the old style of cast-iron furnace, but during the summer of that year the university erected a boiler-house and put in a steam-plant to supersede the old

and unsatisfactory furnaces.

On October 20 of that year, now eight years ago, the writer hereof took charge of this steam apparatus. The boilers, three in number, have been described to this club before, in a paper by Mr. Charles F. White, in May, 1880. But as some of you may not have been present on that occasion, I will state that they are 16 feet long, 5 feet in diameter, containing 36 4 inch tubes, and have each 750 square feet of heating surface, and are rated 75 horse-power. The tubes are arranged so as to leave a space of 12 inches width in the centre, so that a man entering the manhole on the lower side of the front head, can pass up between them, thus affording excellent opportunity for cleaning and inspection. This arrangement of the tubes, to the best of my knowledge, was an original idea of the late Professor Charles A. Smith, and it has proved a most excellent one, as it is this central water-space, in my opinion, that has protected the boilers from injury during these eight years of the extremely heavy duty to which they these eight years of the extremely heavy duty to which they have been subjected, and to the free and rapid circulation this space has afforded is probably due the remarkable work they have been found capable of. Two of these boilers, when designed, were expected to be amply large for the work of heating the buildings and running the engine in the manual training-school shops, leaving one in reserve, for cleaning or repairs if necessary, but buildings since added and rooms in the old buildings not then occupied and not thought worth using, as they were difficult of access, but since brought into use to meet the cult of access, but since brought into use to meet the growing demand for more room, necessitating the putting in of additional radiators, these have long putting in or advanced as since used to since used up our reserve and compelled us to crowd all three of the boilers to double their rated capacity. It was also found upon careful measurement that the buildings are nearly 30 per cent. larger than they were considered to be in the original estimate. The buildings since added are the school building, at the manual training-school (the shops now occupying all of the original building), the gymnasium and the observatory. These additions required an increase of about 21 per cent. in the heating pipes. An additional reason is also found in the higher temperature demanded by the occupants of many of the rooms. Formerly they were satisfied if the temperature reached 68 or 69° Fah.; now they demand 73 to 75° Fah., and we have had complaints that this was not warm enough. This has always occurred in rooms heated indirectly, and, I think, must be owing to the fact that the occupants are in a gentle current of dry air; for we all how much cooler it seems in summer on a day when the air is dry, than when it is charged with moisture, although the thermometer may read higher in the former

As we have both systems of heating at the university, direct and indirect, a brief consideration of the merits of the two systems may not be out of place here.

Experience has shown the indirect to be the most satisfactory where there are a number of persons congregated, and who remain in the room for a considerable time, which is owing to the perfect ventilation obtained by this means; and it is the unanimous testimony of the teachers engaged and it is the unanimous testimony of the teachers engaged in rooms heated in this manner that when the rooms were heated by the old furnaces a short time in them would frequently bring on headache. Now they can spend an unlimited time in the rooms with perfect comfort. Pure air is not always found where the direct system prevails. As an instance of this, I well remember being called at one time to attend to a trifling leak around a valve-stem in a room heated directly. There were about sixty boys in the room. On first entering from the pure, fresh air of outdoors I was surprised to find a disagreeable odor, which was also noticed by the janitor, who accompanied me. On inquiry I found that it was not perceptible to those who were in the room, they having been there some hours. The indirect system, however, is the most expensive in fuel, probably to the extent of twenty-five to thirty per cent., but the perfect purity of the atmosphere of the rooms justifies the additional expense. Another strong point in its favor lies in the fact of its being situated in the basement, which admits of any trifling derangement being attended to without disturbing the occupants of the rooms. On the other hand, buildings heated by the direct system can be more quickly warmed; hence, it is seldom found necessary to heat these buildings over night, which must always be done, except in very mild weather, in those buildings heated indirectly, which accounts for part of the greater cost of heating indirectly, the remainder being found in the larger heating surface required; but the greater cost is far outweighed by the benefits accruing to health and comfort.

The buildings comprising the university

The buildings comprising the university group, and which have to be heated by the three boilers mentioned, are eight in number, as follows: The university building, comprising the college and polytechnic schools, the chemical laboratory, gymnasium, observatory, manual trainingschool (two buildings, school and shops), Smith academy, and museum of fine arts.

To these must be added the Second Presbyterian church,

which is heated on Sundays, and also for two evenings

during the week and at irregular times when needed for weddings or funerals.

The university is heated principally by the indirect system, but is supplemented by direct radiators in some of the rooms which have been found difficult to warm. The arrangement consists of small vertical tubular-boilers set in brick chambers, which are connected by suitable coldair flues with the outer air, which is conducted under these boilers, passes up through the tubes and around the shell, to the flues leading to the rooms. These boilers are each 8 feet in height by 3 feet in diameter, containing thirty-four 4-inch tubes, making 344 square feet of heating sur-face in each. The Smith Academy and Art Museum are heated by direct radiation, as is also the gymnasium and the observatory. At the manual training-school we have both systems combined, which are so arranged that we can heat either with the exhaust from the engine or with steam direct from the boilers. Here we do altogether the best work; the exhaust from the engine is found sufficient, until the thermometer falls to within 10 degrees of zero, for both buildings, when it will serve for one, the other being heated with live steam. The engine is 12x12 and is developing about 25 to 30 horse-power, running 203 revolu-tions per minute. The exhaust from this engine does this tions per minute. The exhaust from this engine does this heating with little or no increase in the back-pressure; in fact, in very cold weather the back-pressure is somewhat less, owing to the rapid condensation, the pipes in the hot-air chamber forming a condenser, which proves, that with a properly designed system of piping, there need be no loss of power in the engine from excessive back-press-ure; and I am of the opinion that many establishments now heating with live steam could, with very little expense for alterations, heat with their exhaust that is now wasted,

which would make the heating clear gain.

In order to show what our boilers have been found capable of. I introduce a statement of their work during the season of 1884 and 1885. I have selected this season be-cause it was an extremely cold and long one, extending from October 1, 1884, to June 10, 1885. The first ten days of June required us to heat some, the temperature being very low for this month, on the 9th falling as low as 52° Fah. The average temperature for the time stated being very low for this month, on the 6th falling as low as 52° Fah. The average temperature for the time stated was 5° Fah below the normal. The months of January and February were exceptionally cold, the temperature being on many days below zero, compelling us for thirty-seven days in these two months to keep the steam in all of the buildings the entire twenty-four hours.

The several buildings comprising the university group were warmed during the season under consideration the following number of hours each:

•		
The University, including the symnasium, ob- servatory, and chemical laboratory	3.051 t	ours.
Manual training-school, both buildings	2.510	44
Smith academy	1.130	**
Museum of fine arts	1,315	••
Second Presbyterian church	735	**
_		

Making a total of 8,750 hours. The cubic contents and heating-surface of these build-

	Cubic contents.	Square ft. heating surface.	Ratio.
University Chemical laboratory. Gymnasium Obshivatory Manual traiting-school shops.	962,004 53,300 154,000 4,853 242,000	344 500 42	115.5
Smith academy. Museum of fine arts Second Presbyterian church	198,660 465,032 682,350 500,000	2.061 3,500 3,300	" 132.8

*This building has the larger heating-surface, in order to utilize the exhaust of the engine for heating.

Making a total of 3,241,899 cubic feet of space which

Making a total of 3,241,809 cubic feet of space which was heated in the case spoken of by 39,014 bushels of bituminous coal for 216 days, which is 1,038 cubic feet heated by one pound of coal for the entire season.

To do the work required we frequently burn as high as 2,400 pounds of coal per hour, on 72 square feet of grate-surface, 33½ pounds per square foot, which, at 6 pounds of water per pound of coal, gives 14,400 pounds of water per pound of coal, gives 14,400 pounds the evaporated at an average pressure of 45 pounds, the evaporation reaching 6.4 pounds of water per square foot of heating-surface. This is heavy duty, I know, but numerous trials have proved that these boilers regularly

perform this duty when required. It was expected, when these beilers were first erected, that we would be able to show, at the end of each day's run, just how much water had been evaporated without the trouble of regular trials. For this purpose the returnthe trouble of regular trials. For this purpose the return-pipe from each building was fitted with a meter, but they had to be taken out, as it was found that the return of the water was intermittent, not flowing until there was suffi-cient hydraulic head to move the meters; in the mean-time, the water in the boilers would get lower than was desirable, so the meters were taken away, and the tank upon which they had been placed was fitted up as a feedwater heater, and glass gauges placed upon it, so that the height of water in it could be seen. This tank has been filled a number of times, and the water drawn off and weighed, thus establishing lines between which is a known weight of water. By this means we can at any time run a trial to ascertain the evaporation.

During the eight years that these boilers have been running several attempts have been made to introduce a smokeless furnace. The first of these was a furnace by smokeless furnace. The first of these was a jurnace by B. F. Smith, of Chicago, which was built in March and April. 1880. The arrangement consisted of a sort of basket built out of 2-inch pipes, placed vertically in front of and connected to the boiler, being enclosed in brickwork. The fire was to be forced by a fan-blower, the products of combustion passing under the boiler through the opening of the fire doors (the doors being removed), the entire furnace space under the boilers being filled with fire-brick, built up pigeon-hole fashion. After a number of trials and the construction of three different furnaces, this attempt was abandoned, it being a complete failure, as it would not maintain sufficient steam to run to remove the smoke nuisance cost over \$2,100, which was bonne by Messrs. Huse, Loomis & Co., of St. Louis.

The secand attempt to introduce a smokeless furnace was made in the spring of 1884, which was a furnace designed by Mr. J. S. Williams, of St. Louis. This furnace was quite an elaborate and complicated affair, contemplation was dutte an elaborate and complicated anali, contemplating the admission of air by forced draft, both above and below the grate. The air admitted above the grate was expected to be a known measured quantity, gauged to suit the theoretical amount demanded for the coal fired, which was to be carefully weighed, and fired in small quantities, about 16 to 20 pounds at a time. The delivery of air was to be in sufficiently large quantity to secure perfect combustion when the coal was first fired, gradually decreasing as the coal burned, until it reached the incandescent state, when the supply of air would be cut of entirely. This air was also to be admitted in time streams, just above the fire, at a high velocity, conditions which seemed to meet the requirements for perfect combustion.

The furnaces (two) were built in the ordinary furnace space, after removing the fire front with its fixtures, the grates being placed 4 feet 4 inches from the lowest part of the shell of the boiler. A central brick pier pierced with small, round holes on both sides, communicating with an air-chamber in its centre, was built, the air-chamber being connected with the blower. This pier also served to support one end of the fire-brick arches which interposed between the fire and shelf of the boiler. These arches, or perhaps more properly, series of arches, were fire-brick, in single rows, spaced two inches apart, running back from the front about 5 feet. The side walls were also pierced with the small, round holes for the admission of air, the idea being that the air entering from both sides of the furnace, at high velocity and in fine streams, would thoroughly mix with the gases passing off from the coal, and perfect combustion would be the result. This furnace did give very good results as to being smokeless, but its capacity was so small, and it gave such evidences of being difficult and expensive to operate and maintain, that was taken out during the following summer. Cost to the university, \$536.28.

The third smokeless furnace tried was the patent of the Backus Furnace Company, of Detroit, Mich. This furnace consisted simply of two fire-brick arches, built in the common furnace, one inside each door, extending inwards 2½ feet, where they had a drop wall 9 inches thick descending to within 9 inches of the grate-bars.

This also failed to do the amount of work required of our boilers, by about 40 per cent.

This gentleman action

our boilers, by about 40 per cent. This gentleman accepted his defeat in a most graceful manner, paying all the expenses of building and removing his furnace. I may add that we have also tried other devices suggested may and that we have also tried other devices suggested to us by our own experience and that of others with the same unvarying result—viz., whenever we have admitted air above the grates it has resulted in a loss of capacity, which, in our present condition, we cannot spare.

The cost of the entire steam-heating apparatus to the University is as follows:

University is as follows:

Land					\$500.00
					2,873.00
					2,990.≎0
					. 627.00
					233.91
Heaters at	Universi	ity			2,312.00
Setting the	same	· • · · · · · ·		. 	2 12 60
Heaters in	Academ	y			2,125.56
Heaters in	mauual	training	-schoo	l shops	1,404.00
**	**	٠.	••	rooms,	1,200.00
Total					\$17,048.07

The cost of the heating apparatus in the museum of fine arts I have been unable to ascertain, as this building was deeded to the university complete in every respect by the

SOME EXPERIENCE WITH UNDERGROUND PIPES.

As the several buildings heated from our boilers are some distance away from each other and from the boiler-house, the pipe system underground, connecting them with the boilers, forms no inconsiderable part of the whole plant, requiring, as it does, nearly 1,000 feet each of steam and return pipes. From this it wil readily be seen that in the eight years these pipes have been laid we have had considerable experience with underground pipes.

The main line to the university is 400 feet long, and

had considerable experience with underground pipes.

The main line to the university is 450 feet long, and has, leading out of it at right angles, three branches 51 feet, 15 feet, and 12 feet long, respectively. The line 10 the manual training-school is 314 feet long.

The line to Smith Academy is 90 feet long. The one to the museum of fine arts is 63 feet lorg. All of these pipes, with the exception of the line to the museum of fine arts, were originally laid in pine boxes made of 2-inch arts, were originally laid in pine boxes made of 2-inch lumber, which were well tarred, both in ide and outside.



^{*} Read before the Engineers' Club of St. Louis by Charles E. Jones, and published in the Journal of the Association of Engineering Societies.

The pipes were wrapped, 1st, with a sheet of asbestos paper; 2d, with three-quarters of an inch of hair felt; 3d, with a heavy, strong wrapping paper, the whole securely bound around with strong twine. The intervening space in the box was filled with coke breeze.

The pipes to the art museum were laid in what is called "gutter pipe," which is one-half of the cylinder of sewerpipe. In this case the intervening space was filled with ground charcoal, made into a paste with cement, the whole covered with another half-cylinder or "gutter pipe," forming a complete circle, inside of which the pipe was inclosed. There were some short lengths under the floor of the boiler-house that were simply plastered over with of the boiler-house that were simply plastered over with cement and the brick floor above them carefully grouted with cement, which, it was hoped, would keep the water from them. These pipes lasted just two years, and when taken up it was found that the expansion had cracked the cement off them, which allowed water filtered through the bricks of the floor to reach them, which the heat of the

pipes evaporated, thereby destroying them very rapidly.

These pipes were renewed at the time of the burst, but the following summer the arrangement was changed, so that these pipes were run overhead, where they should have been in the first place; but as this work was done during vacation, when every one connected with the university who knew how such work ought to be done was away, the intelligent (?) pipe-fitter ran things to suit him-

This was the beginning of our troubles, for during the succeeding winter we had to replace the pipes supplying the gymnasium, where it was found that a defective drain had freely supplied the covering of the pipes with water, this covering (as described previously), acting as a sort of sponge, absorbed large quantities of water, thus keeping the pipes wet, which insured their rapid destruction.

During the same winter the heavy oaken boxes built around the expansion bands had to be rebuilt (this time of

around the expansion bends had to be rebuilt (this time of brick). The heat from the pipes inside of these boxes, with the moist earth outside, rotted them so badly that in the short time of two years they were in danger of caving in. While rebuilding these expansion chambers, it was thought advisable to connect them with the sewer, to drain them, as on one occasion, during a heavy rain-storm, drain them, as on one occasion, during a heavy rain-storm, the street gutter becoming obstructed, the water ran into the chamber and flooded the pipe boxes. The winter following (1883) the pipes supplying what is known as the physical laboratory wing of the university gave out; here again it was found that the non-conducting covering had hastened the decay of the pipes. The yard through which these pipes are laid not being paved, whenever it rained the water readily found its way through the ground and was soaked up by the covering, which kept them wet much longer than if they had been without covering.

In the winter of 1884 the pipes to the museum of fine arts gave out. From these pipes I had expected long service, thinking that there was no possible chance for water to reach them, but it was found that owing to their being packed tight in the "gutter piping" with the charcoal filling, the expansion and contraction had broken the joint between the two halves of the gutter pipe, thereby allowing

ing, the expansion and contraction had broken the joint between the two halves of the gutter pipe, thereby allowing the charcoal filling to absorb the moisture from the earth, with the usual result—viz., rapid destruction of the pipes. In the next winter (1885) the pipes supplying the manual training-school failed. Here it was found that the pipe-fi.ter, with his usual forethought, had run the pipes immediately under some water-closets, so that any overflow from the closets dripped down upon them, and although they were covered with a coating of cement the expansion had cracked it so that the water readily found its way to them. Thus burst succeeded burst every winter, until in April, 1887, a burst in the main return-pipe (from the university) created considerable anxiety regarding the April, 1887, a burst in the main return-pipe (from the university) created considerable anxiety regarding the condition of the whole main line, which up to this time had given no trouble. About 535 feet of the main line is laid in St. Charles Street, which is macadamized, and has good drainage, and it was hoped that these conditions had secured to the pipes underlying the street immunity from our enemy, water. This afterwards proved to be the case, as far as we took it up (335 feet), with the exception of about 25 feet immediately underlying a point in the street where the surface had become broken. As the need for a separate pipe to run the various small engines need for a separate pipe to run the various small engines in the physical and mechanical laboratories and elevatorn the physical and mechanical laboratories and elevator-pumps had become pressing, it was finally decided to open the street to a point opposite the manual training-school, where an attachment could be made to the pipe supplying steam to the engine in that building, which would give these machines steam of the proper pressure, and separate them from the heating system, which was desirable, owing to the fact that we were compelled to maintain such pressure as would run these machines in the heating apparatus, which often resulted in largely overheating the buildings.

buildings.

It was also decided to renew those pipes that passed through the yard, and as our experience had been adverse to the use of covering around the pipes, owing to its acting as an absorbent, and also to an objectionable smell from it, when wet, finding its way into the buildings. It was now determined to protect it in a different manner. As I am of the opinion that there is no better non-conducting medium than confined air, that was the plan adopted. First, a floor of hard hydraulic pressed brick was laid down in cement, and well grouted in; a single course of brick was then laid along edges of the floor, forming a "stringer." Upon this stringer 21-inch "gutter pipe" was laid, forming an arch over the pipes. All joints and connections were well cemented. I his, it is believed, will keep the pipes dry, but if water should get

in it has a chance to run away to the sewer connections in

in it has a chance to run away to the sewer connections in the expansion chambers without wetting the pipes, as they are carried on rollers 1½ inches in diameter, and the floor is slightly hollowed out in the centre under the rollers.

The cost of protecting these pipes in this manner has been \$1.25 per running foot. The value of the pipes is about \$3 per foot.

As stated heretofore, the pipes in the street were found to be in fairly good condition; the boxing was badly rotted in those parts where it was only a short distance below the surface (about three feet at the shallowest part:) below the surface (about three feet at the shallowest part;) the top, which had been put on without cross-bars under it, was split its entire length, and was crushed in, so that the middle of the boards rested upon the pipes, the edges remaining on the sides of the box. The covering that was remaining on the sides of the box. The covering that was around the pipes had also rotted away to a large extent, leaving the upper sides of the pipes uncovered; some portions of it was found in the lower part of the box among the coke breeze which appeared to have been ground down by the contraction and expansion of the pipes until the box was only about half full or slightly less, it being less than half its former bulk, as the boxes when laid were followed to their warest consents: filled to their utmost capacity.

PLUMBING IN THE RESIDENCE OF MAX NATHAN, ESQ.

No. II. (Continued from page 152.)

THE arrangement of pipes in the kitchen and a portion of laundry is shown in Fig. 4. Two boilers are represented: A' for the low (street) pressure supply and B' for high (or tank) pressure Only one water-back is required for heating the water for the two systems of supply. A heater is provided as shown between the boilers at C', which is explained in detail in Fig. 4, to which the reader is referred to clearly understand the following description. The general course and use of each pipe is as follows: The low-pressure supply flows |

When the high-pressure system is in use, the stop-cock projecting above marble slab is opened, which permits water to flow into fixtures, but prevented from flowing into low-pressure system by a check-valve.

The hot water in pipe D passes up through check-valve to supply toilet-basin through D'. A pipe branches from D in hall, indicated by D', passing into and through laundry, drying-room, and into storeroom, and up partition wall to second floor, thence along floor to cut-off in dressing-room. The cold water flows direct from pipe A in cellar up through elevator shaft at M to cut-off in bathroom, shown in Fig. 5, passing to toilet-basin through pipe M". The cold supply for toilet-basins in dressingroom runs vertically from cellar through storeroom to cutoff in dressing-room. The pipe E branches from B below heater, and is carried up back of it into hall and up to cut-off in bath-room, connected with D, as shown in Fig. 5, being utilized as a circulating pipe. The branch E' in hall runs parallel with D' to dressing room and there joins the cut-off in a similar manner, utilized for the same pur-

The high-pressure supply from tank is marked H in Fig. 4. The cold supply passes down elevator shaft, entering boiler B' at top, thence down as shown by dotted line and out at I, thence through J to water-back, passing out that through K to heater, where it heats the lower pressure supply which surrounds it; thence returning to boiler through L, and up through G' into elevator shaft, terminating over tank to relieve pressure in boiler. A pipe branches from G on second floor for cut-off, as shown in Fig. 5. Pipes branch also from this pipe on third and fourth floors to supply fixtures in bath-rooms.

The pipe C' branches from G in hall, thence parallel with D' to cut-off in dressing-room, connecting as shown in

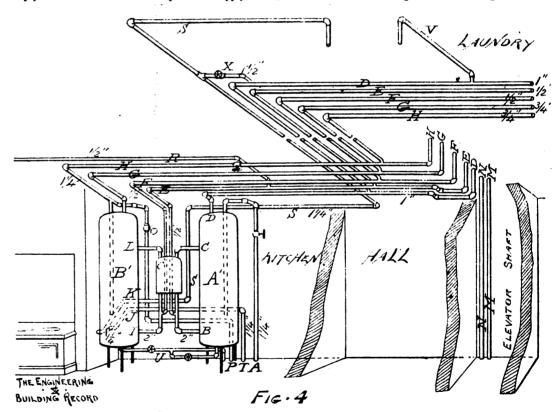


DIAGRAM SHOWING PIPE SYSTEM IN KITCHEN AND PART OF LAUNDRY RESIDENCE OF MAX NATHAN ESQ. N.Y.

from grease-trap up through pipe A, entering the boiler A' at top, thence down as indicated by dotted lines, passing out at B and up into heater C'. The water returns hot into boiler A' at C' and out into pipe D, passing through hall and up elevator shaft, supplying hot water for all fixtures in bath-room on second floor.

A cut off is illustrated in Fig. 5 that is secured to toiletbasin in bath-room, which is utilized to facilitate the control of the two systems of water-supply.

A duplicate cut-off is attached to toilet-basin in dressingroom on second floor, and the description now to be given applies to both. Four pipes are shown in Fig. 5, two for hot and two for cold water, M and D being the low-pressure, and H and G high-pressure supply. Stop-cocks are set between each pair of pipes as shown.

Projecting above marble slabs stop-cocks are set in pipes M and D for use when the check-valve fails to work

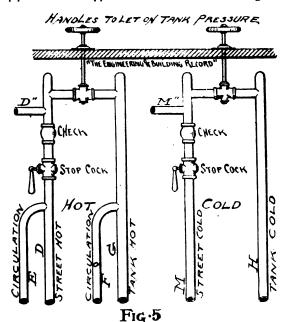
Fig. 5. The pipe F is a circulating pipe for high-pressure system, and branches from I below heater, thence up parallel with E to cut-off in bath-room, as shown in Fig. 5. A branch, F', leaves F in hall and runs parallel with E' to cut-off in dressing-room.

The cold supply for high-pressure system flows through branches from H on each floor running to fixtures in the bath-rooms. The cold supply from high pressure for dressing-room branches from H in hall, passing through H' up to cut-off. The pipe R branches from E and runs to opposite end of kitchen to furnish hot water for sink, extending also to butler's pantry. The cold supply for the sinks in butler's pantry and kitchen come direct from cellar. The waste-pipe from boilers is shown at U. The pipe P runs from cellar back of boilers and connects with high-pressure pipe H for an intermediate supply through check-valve O, between the high and low pressure systems. The boilers A' and B' contain 100 gallons each.

Digitized by GOOGLE

The connection between the kitchen and laundry range will now be described. The supply to water-back in laundry range is indicated in Figs. 4 and 6 by I. This pipe branches from pipe B under heater, passing back of boiler A' and down to cellar, there suspended to ceiling, and up to laundry-range, as shown in Fig. 6 at T. The pipe S branches from B above T, thence passing into hall and crossing over the pipes shown in Fig. 4, passing into laundry and down to range, as shown in Fig. 6.

The pipe V, in Fig. 6, branches from D' and passes over range and down, connecting with a stationary copper clothes-boiler in opposite end of range. A branch from this pipe extends down into cellar. A waste-pipe from clothes-boiler runs to cellar also, and is shown at W. A pipe connects copper boiler with flue above range to

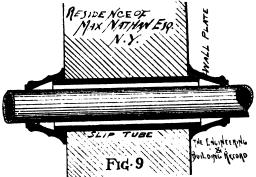


Detail of cut-off between high and low pressure supply.

Residence of Max Nardan Esq. N.Y.

remove excess of steam. If the hot water in flowing through pipe S from kitchen to laundry should meet water circulating from laundry range towards the kitchen with the same velocity, there would be danger of the flow becoming air-bound, and to avoid such a contingency a connecting pipe is inserted between S and D', in which a valve is set, as shown at X in Figs. 4 and 6. This valve is intended to be left open sufficiently to permit passage of air into D', but not open enough to affect the direction of flow in pipe S and D'.

The illustration in Fig. 6 is a view of clothes-drying rack, one of which is drawn out into laundry. The drying-room, as previously stated, is situated between toilet-room

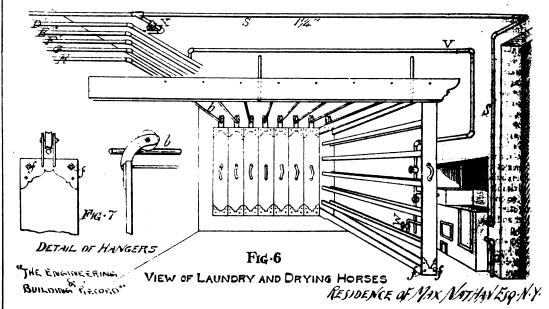


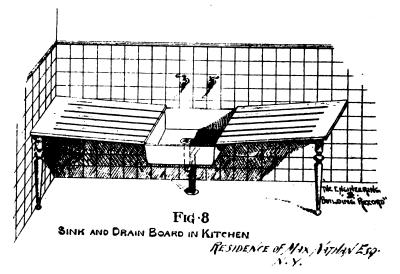
METHOD OF SECURING PIPES THROUGH —

and hall, the dimensions being about 8x10 feet. The device for drying clothes consists of eight horses, each being six feet high, eight feet long, and one foot in width. They are suspended on tubes with iron rollers, as shown in detail at b and f in Fig. 7. These hangers consist of iron plates screwed to front and rear ends of horses. The iron braces carrying the rollers are a continuation of the plate, all being one solid piece. The frame of the horses consists of boards, front and rear, fastened together by four strips set in pairs, two at top and two at bottom, which form the frame. These strips are 1x5 inches at top and 1x6 inches at bot-

tom; but the latter has one inch of width cut out nearly the whole length of lower edge, as shown in Figure 6. A plate corresponding to top, minus the braces carrying roller, is secured to front and back at bottom. To supply additional strength to these horses rods are inserted, each one-half inch in diameter, running in pairs the entire length at top and bottom, their position being indicated in Figs. 6 and 7 at F by heavy black circles. The tubes on which the rollers travel are suspended in laundry as shown by a horizontal girder 2x8 inches. This girder is supported by two hangers made of galvanized pipe secured to ceiling, and also by one end resting on partition wall. The tubes on which the rollers travel are suspended from ceiling in drying-room by means of hangers also made of pipe. Each horse is provided with wooden bars that form the racks on which the clothing to be dried is suspended. The bars are in pairs as shown, and are 1x2 inches, mortised into front and back of frame. A handle

JOHN SEALY HOSPITAL AT GALVESTON. THE Committee on Building the John Sealy Hospital, to be erected at Galveston, Tex., through its Secretary, Dr. W. H. Baldinger, officially notified Architect N. | Clayton that his plans for the structure have been adopted. Mr. Clayton has embodied in his plans all the latest improvements in hospital construction and sanitary arrangements, particularly concerning ventilation, heating, the comfort of the patients, and the convenience of the management of the institution. The plans adopted embrace all the important features to be found in all the leading hospitals of the country. The system of buildings consists of four separate structures, conveniently grouped and connected together, yet entirely isolated from each other by scientific means and for sanitary reasons. The administration building is a square structure, forty six feet on each side and ninety feet high. It consists of three stories above an eight-foot basement, and is terminated by





is secured to front for use in throwing them out. Coils of steam-pipe run on floor in drying-room under the horses, supplying the heat necessary for drying purposes.

The kitchen sink is located on opposite side from hall, and is shown in Figure 8. Draining boards are provided on each side made of ash with grooves, as shown, that are about three eighths of an inch in depth, and two inches apart. These draining boards are secured to the wainscot and outer edge, supported on turned legs of ash. A rim of wood is secured to entire edge exposed to prevent dishes from slipping off. A wainscot of tiles extends from floor up above this sink.

Figure 9 shows the method of supporting pipes at all points where they pass through partitions. The device consists of a short tube passing through the partitions with a thread cut on each end, which permits a wall-plate to be screwed on. These tubes are large enough to allow the collars of each pipe to slip through. When the pipes are inserted and wall-plate screwed in position the pipes are suspended in the centre of the tube.

(To be continued.)

a curved pavilion roof, and fronted with a covered portico On each side of this pavilion is situated one of the ward buildings, thirty-three feet by seventy-six, and sixty feet high, thus making, with their connections to the adminis. tration building, and this building itself, a continuous length of 218 teet. The wards will consist of two stories over the eight-foot basement, the first story being devoted to the medical ward and the second story to the surgical ward. As there will be two such wards of two stories each; one will be devoted to the accommodation of male and the other to that of female patients. An elevator, located in the interior of the administration building, and of such dimensions as to admit a bed or stretcher, will facilitate access from this central point to either of the wards, and carriages will be enabled to drive through a porte cochere existing behind the front steps, right up to the very starting point of that elevator in the basement. The domestic service of the institution will be accommodated in another separate building.

THE FALL OF THE ELEVATED RAILROAD HOISTING-ENGINE IN BROOKLYN.

On Broadway, in Brooklyn, J. B. & J. M. Cornell have for some months been erecting a structure for the use of the Union Elevated Railroad Company. The columns are of 15-inch channels, latticed in the usual way, and at the point where the accident occurred were spaced sixty feet apart longitudinally and forty-five feet apart transversely. They were connected by single transverse plate-girders about four feet deep, with reinforced chords. On the top chords of these rest the four lines, two for each track, of longitudinal drop-end plate-girders, which are four feet deep, with \(\frac{1}{2} \)-inch webs, and unreinforced chords of $6 \times 6 \times \frac{1}{2} \times 1$ -inch angles, weighing about six tons each.

The columns and transverse girders having been erected by portable derricks, the longitudinals are hoisted into place by trussed arms secured between the pairs of longitudinal girders already erected and extending half-way over the next span. The hoisting-engine and boiler for this work are carried on a platform traveling on the longitudinal girders, and which, when in use, is nearly over the transverse girder between the two last-erected spans. About 10 A. M. on the 14th inst. a set of longitudinals had just been erected, the trussed arms had been placed in position, and the traveler, weighing ten or fifteen tons, was being hauled ahead for a fresh lift, and had a little passed the centre of the next to the last erected span, when, without w arning, it fell to the street below with the four girders on which it rested.

A horse car passing underneath was crushed, the driver and two of the erecting gang were instantly killed, another man has since died, and about a dozen others were more or less seriously injured.

It is not possible to fix the immediate cause of the accident with absolute certainty, but the following facts may be noted as suggesting a possible explanation:

The longitudinal girders, attached by only two bolts at each end, are not braced in any way whatever until after the traveler has passed. This is done partly to avoid the inconvenience of having a gang of riveters between the traveler and its work, and partly to avoid having the traveler run over the heads of the rivets used to attach the bracing.

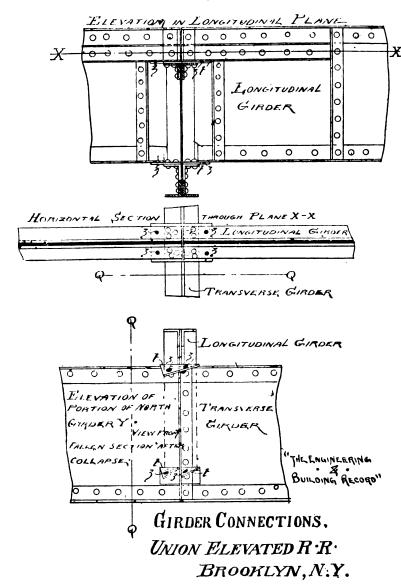
The girders that fell all laid with their top chords in the same direction.

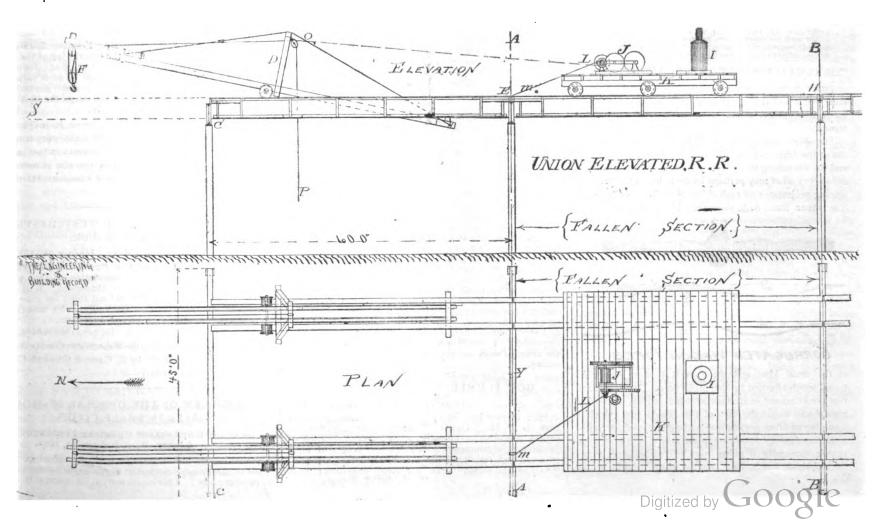
They bore evidence of all having been bent in the same direction before striking the ground, which they did upon their convex sides, and were more or less straightened again by the fall. The cracks, bends, and buckles in both top and bottom chord angles plainly showed this.

Of the sixteen unbraced girders left standing all but one or two that were practically straight were curved more or less, some of them apparently as much as two inches, in the direction in which the others fell. This curvature was probably due to rough handling on trucks or lighters, or in transfer from one to the other, but that

it should have always been in the same direction seems at least a singular coincidence.

Lastly, the men engaged in hauling the traveler ahead stated that the rope, instead of being fastened directly ahead, was led off very much to one side, so as to pull the traveler strongly in the direction in which most of the





other girders were already sprung, and in which the ill-fated ones actually fell.

DESCRIPTION OF ILLUSTRATIONS.

In the details of girder connections, t t show the plates by which the longitudinal were connected to the transverse girders, and z z are the holes for the connecting bolts, which had been put in the upper plates only. The elevation of a portion of the transverse girder Y shows the plates t t as they appeared after the accident, bent down on the side toward which the tops of the longitudinal girders lay after they fell. Only one lower plate was so bent.

On the general plan and elevation, D shows the trussed arms secured in place ready to lift the next set of longitudinals by tackle F with hoist-rope O running back to hoisting-engine J, which, with boiler I, was carried on traveling platform K.

It was originally intended to have had the hoisting-engine on the ground, in which case the hoist-rope would have led downward as at P, but this was not permitted.

The rope L, by which the traveler was being hauled ahead, is said to have been made fast at the point m on girder Y. While this may have afforded a reasonably fair lead when the traveler started from the previous span, it was obviously exciting a strong lateral pull when in the position shown, which, as near as can be ascertained, is about where it was when the accident occurred-

Everything between points A and B fell to the ground. The tops of the fallen girders lay toward what would be the west if the arrow on the plan pointed due north, as shown. It really points about north-west.

As already mentioned, almost all the unbraced girders left in place were more or less sprung in that same direction. The columns were just inside of the curb lines.

Gas and Electricity.

Illuminating	Power of Gas in New York City.
Week ending	New York Company. Manhattan Company. Metropolitan Gas-Light Company. Metropolitan Gas-Light Company. Mutual Gas-Light Company. Muricipal Gas-Light Company. Muricipal Gas-Light Company. Muricipal Gas-Light Company. Kinckerbocker Company. Kinckerbocker Gas-Light Company. Kinckerbocker Gas-Light Company. Kinckerbocker Gas-Light Company.
February 11	22.80 18.98 20.83 28.93 27.87 21.47 30.46

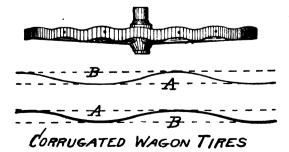
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

CORRUGATED ROLLED STEEL WAGON-TIRES

THE illustrations show Fox's patent corrugated rolled steel tire, a recent English invention, designed especially for use in towns where tram-lines are laid through the streets.

The object of the invention is to assist the wheel to get out of the tram-line and thus avoid skidding of wheels and the wrenching of vehicles and horses. The invention consists of what may perhaps be described as a series of sloping projections on each side of the felloes of the wheel. The inner lines, A A, show the width of a plain tire-bar



of the usual kind, and the lines B B show the additional width afforded ty the projections. It is claimed that the increased width thus afforded enables a wheel to engage and mount the sides of the groove into which a tram-line so often degenerates without a wrench or jerk—a matter of great importance in the case of a heavily laden vehicle, especially if going down hill. The Leeds Forge Co., Limited, Leeds, Eng., are the manufacturers of the tire.

INDICATOR-DIAL FOR STEAM-GAUGES, ETC.

DANIEL L. MITCHELL, of Taunton, Mass., has patented the right to paint one-half of his steam-gauge dial black or red, it he chooses, and leave the remainder white. His object is to provide a danger-field on the face of a gauge, the better to warn the attendant of the limit of safe pressure. His first claim is: "A sight-signal or indicator having a field or dial the face of which is painted or otherwise made in two strongly contrasting colors, with a clearly-defined dividing-line at any desired point, in combination with an index-finger or pointer arranged to move over said field or dial, and having its outer face painted or otherwise made in the same two strongly contrasting colors."

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ON THE POLICY OF MAKING LEAD BENIS IN PLUMBING SHOPS.

NEW YORK, February 1, 1888.

SIR: In reference to its being profitable, I cannot agree with the writer of the article "Regarding the Making of Lead Bends," in your issue of January 7. 1888. His method of forming the bend is ingenious and new to me as applied to this particular industry, but not new to the old-time plumbers who were often called upon to make water-backs out of iron pipe. Just about such an arrangement of blocks was used by them, only the faces of the blocks were neatly lined with band-iron to preserve them against the red-hot iron pipe. In those days our bends and traps were all made up in the dull months of winter and midsummer, by hand, but sheet-lead was the invariable material. Those were the halcyon days of plumbing in this country for the journeyman. In our shop a 4-inch S-trap was a day's work, and I have often wondered if the boss—who, by the way, was a long, lank, good-natured New York plumber, with a down-east twang—ever laid awake nights trying to learn why it was that twelve men could work six days and produce each a 4-inch S-trap at the close of the day and still have only twelve to twenty traps on the shelves at the end of the week.

Some of the old timers can explain it. My present foreman is of that ilk, and he says it don't pay to make traps and bends in the shop—and he knows; that is, looking at it from the well-worn bench in a good-natured way. Now, how does the man in the office view it? He says two feet of 2-inch pipe weighs ten pounds, at a cost of six cents per pound. Correct, Mr. Stool; but if the boss can buy a 2-inch machine-drawn bend, perfect in shape, uniform in calibre, and equal in thickness and strength throughout for "from forty to fifty cents," will you tell me how it can be profitably made on the bench if the pipe alone costs 20 to 50 per cent. more than the complete machine-made bend, to say nothing of the cost of the other items that go with the hand-made article—as time, fuel, solder, etc.? Mr. Stool says, "That's my question, and I will go on hunting for that little mistake in my trial balance while you work it out."

BUFFALO.

SIR: In reference to the matter of lead bends referred to in THE ENGINEERING AND BUILDING RECORD of January 7, and to the policy of keeping men employed in making same when work is dull, it might be well to have a few on hand in any shop, as they might suit in some instances. But in regard to keeping men employed for any length of time on such work, it would not pay any employer. Take any good plumber and put him on work where such bends are required and he will prefer to make his bends to suit the different positions. Besides, a good workman would make as many of these bends in one week as the average plumbing establishment would use in a year—that is, of 1½-inch and 2-inch; those are the sizes referred to; the larger sizes can be purchased cheaper than they could be made up. I think the plumbing trade of the country are at a loss to k..ow at present what they could keep some good men employed on in dull times in their workshops that would pay. I made up some lead service-boxes two years ago and have had them on the shelf until within a few weeks; however, they came in good for old lead for calking, etc. I have a few good men that I may in a short time not have work for, but I wish to keep them employed. I would really like to know what I could put them to work on that would remunerate me for the outlay.

HOW PLUMBERS MAKE LEAD BENDS.

MILWAUKFE, Wis., February 6, 1888.

SIR: In your issue of January 28 is a communication from L. D. H., giving very workmanlike instructions in regard to making lead bends, and as I wrote the article of January 7, recommending the use of bench-blocks, I wish to thank your correspondent for the article above referred to, and would like to hear from him further.

W. G. NICHOLSON.

TON, D. C. STAUNTON, VA., January 30, 1888.

EXAMINATION OF PLUMBERS IN WASHING.

SIR: You will please let me know through your valuable paper what examination a plumber has to stand in Washington, what questions are asked, and what answers given. If they have been published in your paper please forward me copy of same. What license does a plumber have to pay in Washington? By answering the above you will greatly oblige C. B.

[At present no examination is required, nor any license fee, the regulations adopted by the District Commissioners last spring having been declared illegal by the court. The regulations in question (under which nearly all the master plumbers of Washington were examined last summer), were printed in our issue of April 30, 1887. The nature of the questions asked is there stated, and a report on the examinations was given in the issue of October 1, 1887.]

NOISE ABOUT BOILER PROBABLY DUE TO IMPROPER CONNECTIONS.

ARLINGTON HEIGHTS, MASS., February 2, 1888.

SIR In our house we have a No. t Gorton steam-heating boiler supplying about 150 square feet of heating surface. Occasionally, when there is no steam on, the water in the boiler falls three or four inches with a very disagreeable sound (which I cannot explain). You will, therefore, conter a great favor on a constant reader of your paper if you will explain the cause and state remedy for same. Also, when the boiler is filled with coal for the night there is a cracking sound, unlike that heard in the pipes, and at regular intervals. Any information on the cause and cure for this will also be gratefully received by

J. L. B'xby, Jr.

[You do not send sufficient data for an intelligent reply. In cases of this kind a diagram should be sent, showing the manner and arrangement of all the pipe connections and their diameters.

Symptoms such as you describe are usually the result of improperly connecting boilers, and do not show any inherent defect in the boilers themselves. Indeed, they will occur with any boiler improperly connected. If the pipe from the upper end of the combination-gauge cylinder is a branch of the main steam-pipe, it will account for the subsidence of the water after steam is down. Tap it into the head of boiler direct.

Without knowing more about the particular boiler von have we cannot speak as to the cause of the cracking at night. Why it should go on at night any more than in the daytime we cannot understand. The coal slipping through the magazine will make a little noise any time it moves.]

HOT. WATER HEATING IN MR. WYLD'S HOUSE, TORONTO.

GARDINER, ME., February 8, 1888.

SIR: Am much interested in the description of the hotwater heating in the residence of F. Wyld. Esq., Toronto, Can., but would suggest that it would be more valuable were the scale of the plans given, or some method by which we could form some idea of the size of the building.

Yours truly.

C. E.

[The main part of Mr. Wyld's house is 50x56 feet and the extension 34x24 feet. The main story front is 14 feet in the clear and the second floor is 12 feet in the clear. Our custom is either to mark the size of rooms or give a scale. In this case, however, it was omitted through an oversight.]

HOT-WATER HEATING OF WESTCHESTER COUNTY ALMSHOUSE.

MINNEAPOLIS, MINN., January 28, 1888.

SIR: THE ENGINEERING AND BUILDING RECORD of December 3, 1887. contained description of hot water heating apparatus in Westchester Almshouse. Will you please inform me where I can find out about the pipe-coil boiler that was used in that institution, who makes it, etc., and much oblige. Yours very truly,

SUBSCRIBER.

[The pipe boilers used in the Westchester County Almshouse heating were made by C. Garth & Co., 536 Craig Street, Montreal, Canada.]

THE PROBLEM OF THE DISPOSAL OF HOUSE WASTES IN SMALL CITIES.

BELOIT COLLEGE CHEMICAL LABORATORY, BELOIT, Wis., January 31, 1888.

SIR: Can you inform me, through your columns, what is the most advisable method of disposing of house wastes in smaller cities? This whole section of country is upon



a deep layer of drift made up of calcareous gravel for the most part. Our city has an excellent system of waterworks, but no system of sewerage, and we must therefore on our own lots dispose of this waste. How can this be done most effectually, and what is the construction of the best practical cesspool which may not injure either our own health and comfort or that of our neighbors?

I remain yours respectfully, E. G. SMITH.

[The best thing to be done when a town or city has become large enough to have a general system of watersupply is to provide a corresponding general system of sewage disposal, which will provide for this water after it has become fouled by household use.

It is not possible to lay down general rules as to how this can best be done in particular cases, but it is certain that the best thing to be done is to employ an engineer (an expert in sewerage works) to examine the locality and advise as to methods and cost. It would perhaps be possible to devise methods of disposal of excreta and foul water for a single house, which would, at all events, involve no injury to the health and comfort of the inmates of that particular house, but we do not know of any form of cesspool system which can be recommended for a town having a general water-supply.]

CONTROLLING THE DAMPERS AUTOMATIC-ALLY IN A HOT-WATER APPARATUS

SIR: Will you please inform me if there is any practicable way of controlling the dampers automatically in a hot-water apparatus? I have been using a hot-water system this winter and have felt the need of some such device to prevent boiling over through the expansion tank. Any information you can give will be appreciated.
Yours truly, W. P. POWERS.

[E. H. Cook & Co., of Rochester, N. Y., we believe have an apparatus that they claim will control the heat of the water and also open and close air-ducts similar to the ordinary regulating bowl. We believe there are some other contrivances for the same purpose, but we are not conversant with them. Presumably some of our readers can furnish further information on this subject.]

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A REGULAR meeting of the American Society of Civil Engineers was held on February 15. Vice-President J. J. R. Croes presided, and about thirty members were present. Mr. H. P. Bell being absent, his promised paper on the "Estimation of Quantities by Diagrams" was not presented. An interesting paper, by Mr. Gratz Mordecai, Assoc. M. Am. Soc. C. E., was read on "The Classification of Railroad Accounts and the Analysis of Railroad Rates." Mr. I. T. B. Ives, F. G. S., exhibited and explained a "Strata Map," illustrating the geological formation of a portion of the United States by superimposed layers of variously-colored cardboard representing the different strata.

Mr. T. C. Clark, by request, told what was found by the committee appointed to investigate the Albany Capitol ceiling, and described the construction of the groined arches, their loading and subsequent settling and present cracked condition, showing that ultimate failure was inevitable, and outlined the proposed remedies. The irregular and excessive loading of the masonry (in some cases about twenty tons per square foot) was noted and the fact that the foundations sustained it with only a trifling settlement. Messrs. Cooper, Brush, Emery, Bogart, and Lucius joined in the discussion.

CLOSING SALOONS REDUCES REVENUE FROM WATER RATES.

WE saw a statement that the anti-saloon movement at Fargo, Dakota, had resulted in reducing the revenues of the water company.

In response to an inquiry, we learn that this is to a certain extent true, since the breweries and saloons were large consumers and paid proportionate water rates. What this reduction will amount to we presume the official report will ultimately show.

THE MARINE RAILWAY AT HONOLULU.

It was built in 1881, the first ship being hauled up in 1882. The cradle is capable of taking a vessel of 1,500 tons displacement, and 180 feet in length. The charges are 50 cents per ton for steamers and 40 cents for sailing vessels (builders' measurement). The average number of ships hauled up is about seventy-five per annum.

NEW ENGLAND WATER-WORKS ASSO-CIATION.

(Special Correspondence)

THE February meeting of this society was held in Boston, at Young's Hotel, on Wednesday, the 15th inst., and was attended by 65 members and guests, with President Darling in the chair, and a more sociable and thoroughly enjoyable gathering has rarely been known in the history of the association.

Dinner was served at 1:30 o'clock, and when cigars had been lighted President Darling called the company to order, and called upon the secretary to read the names of the applicants for membership who had been approved by the Executive Committee, and the secretary was instructed by vote to cast the vote of the association for the following gentlemen:

Active-Geo. A. Alexander, President Water Company, Bath, Maine; J. W. Ringrose, Secretary, New Britain, Conn.; Geo. E. Evans, C. E., Lowell, Mass.; R. A. Hale, Hydraulic Engineer, Lawrence, Mass.

Associate-Frank B. Durfey, Contractor, Norwich, Conn.; J. Henry Wells, Boston, Mass.

On motion of Mr. Baldwin, Mr. E. R. Jones, the veteran superintendent of the Eastern Division of the Boston Water Works, was elected an honorary member, and the gentleman returned his thanks in a few well-chosen words.

President Darling then introduced the topic assigned for discussion, namely, "The Waste of Water during the Winter Months," and called upon Dexter Brackett, Engineer in charge of the Mystic and Eastern Division of the Boston Water Works, to open the discussion.

Mr. Brackett stated that the cold weather had increased the daily consumption from 35,000,000 to 70,000,000 gal-

In a certain district the night rate of consumption rose from nine to eighty-nine gallons per head, and in another the consumption rose from 5.000 gallons per hour at 8 P. M., to 7,500 gallons per hour at 10 P. M.

Poor plumbing is, in Mr. Brackett's opinion, the greatest cause of this waste. Even if the supply is ample, the loss of head resulting from the excessive draught reduces the head on the distribution so that consumers on high levels cannot be supplied.

Mr. Kent, of Woonsocket, R. I., admitted that the cold weather has caused such trouble by freezing mains and services that he had asked the consumers to waste water to save more serious damage and loss, although it has raised the pumping time from six to sixteen hours per diem.

Mr. R. C. P. Coggeshall, of New Bedford, said that the cold weather had caused an increase of 400 gallons per tap per day. Mr. Nevons, of Cambridge, stated that the consumption had increased 100 per cent., but in spite of this some smaller mains have frozen, and no serious effort is made to prevent the wasting.

President Darling, of Pawtucket, described the results of a broken hydrant, from which the water worked its way for a considerable distance under the frozen surface of the ground and appeared in house cellars where the soft ground allowed it to come to the surface.

Mr. E. R. Jones, of Boston, spoke of the attempts in that city to stop waste by night inspection and by an imposition of fines, both of which have practically failed, and expressed an opinion that at present there is not any practicable method for stopping cold-weather waste. He referred to his experience in 1875, when over 2,000 services had to be allowed to go untouched until Nature undid its own work, and described the method followed in Boston for thawing with hot water and a small block-tin pipe.

Mr. Parker, of Burlington, Vt., has decided that the only way for them to prevent frozen services is to put them below frost, and now covers all pipes with six feet of earth, and if a pipe is found to be frozen it is let alone until spring and is then relaid to a proper depth. The discussion was participated in also by Messrs. Thomas, Hyde, Lockwood, Billings, Hawes, Walker, and Stacey. The following gentlemen were present:

C. F. Allen, Treasurer, Hyde Park, Mass.; J. Henry Brown, Supt., Charlestown, Mass.; Dexter Brackett, Asst. City Eng., Boston, Mass.; E. R. Jones, Supt., Boston, Mass.; W. C. Boyce, C. E., Worcester, Mass.; C. H. Baldwin, Boston, Mass.; Phineas Ball, C. E., Worcester, Mass.: W. R. Billings, Supt., Taunton, Mass.: R. C. P. Coggeshall, Supt., New Bedford, Mass.; Edwin Darling, Supt., Pawtucket, R. I.; A. B. Drake, New

Bedford, Mass.; F. F. Forbes, Supt., Brookline, Mass.; F. L. Fuller, C. E., Boston, Mass.; A. S. Glover, Registrar, West Newton, Mass.; Benj. Grush. Supt., Salem. Mass.; John Harris, Waltham, Mass.; E. A. W. Hammett, C. E., Boston, Mass.; H. N. Hyde, Jr., Supt.. Newton, Mass.; H. G. Holden, Supt., Nashau, Mass.; W. M. Harver, Fall River, Mass.; J. L. Harrington, Cambridge, Mass.; H. H. Knapp, Clerk, Lowell, Mass.; F. E. Hall, Supt., Quincy, Mass.; E. R. Jones, Supt., Boston, Mass.; Jos. A. Lockwood, Supt., Yonkers. Mass.; A. F. Noyes, City Eng., West Newton, Mass.; Hiram Nevons, Supt., Cambridge, Mass.; J. H. Perkins. Supt., Watertown, Mass.; A. G. Pease, Supt., Spencer. Mass.; F. H. Parker, Supt., Burlington, Vt.; Geo. J. Ries, Supt., E. Weymouth, Mass.; A. H. Salisbury, Supt.; Lawrence, Mass.; F. P. Stearns, Chief Eng. State Board Health, Boston, Mass.; Geo. A. Stacey, Supt., Marlboro, Mass.; Solon M. Smith, Supt., Grafton, Mass.; C. H. Truesdale, Supt., Quincy, Mass.; D. N. Tower, Supt., Cohassett, Mass.; M. M. Tidd, C. E., Boston, Mass.; L. A. Taylor, C. E., Boston, Mass.; W. C. Wilcox, Waltham, Mass; S. J. Winslow, Supt., Pittsfield, N. H.; Geo. E. Winslow, Supt., Waltham, Mass.; C. K. Walker, Supt., Manchester, N. H.; H. B. Winship, Norwich, Conn.

Associete-II. A. Gorham, Boston, Mass.; E. M. Bixby, Boston, Mass.; H. F. Jenks, Pawtucket, R. I. J. C. K. Otis, Worcester, Mass.; B. Frank Polsey, Boston, Mass.; F. E. Stevens, Boston, Mass.; C. W. Talcott, Woonsocket, R. I.; George Woodman, Boston,

Guests-Mr Welch; E. T. Ursville, Newton, Mass.; H. A. Goodnough, Boston, Mass.; Mr. Gardiner, Salem, Mass.; Mr. Brown, Salem, Mass.; Mr. Watts, Lawrence. Mass.; Mr. Johnson, Boston, Mass.; Mr. E. D. Holden, Lowell, Mass.; R. J. Thomas, Superintendent, Lowell, Mass.; Mr. E. D. Conant.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met February 1, 1888 President Holman in the chair, thirty-five members and two visitors present.

The committee appointed at last meeting to report to the club suitable action on Mr. Waddell's efforts to reform the present practice in the building of highway bridges reported as follows:

Resolved, That this club express their approval of the pamphlet entitled "General Specifications for Highway Bridges of Iron and Steel," by J. A. L. Waddell, and deem it a well-considered effort to bring about a muchneeded reform.

That we recommend these specifications to the consideration of county and town boards as calculated to give structures both safe and economical when faithfully ried out, but that to insure these results competent engineering supervision is absolutely necessary.

That in the letting of highway bridge contracts, and in the acceptance of the finished structures, such boards shoul!, in all cases, call to their aid a competent civil engineer, and thus insure at once the public safety and the wise expenditure of the public funds. J. B. Johnson, Robt. Moore, N. W. Eayrs, committee.

The report was laid on the table to be called up in two weeks.

The following resolution was moved by R. E. Mc-Math:

Resolved, That the Engineers' Club of St. Louis fully endorse the suggestion recently made by the Chief of the Signal Service that self-registering rain-gauges be provided at all observation stations; also, Resolved, That we request the committees of the two Houses of Congress to insert in the next appropriation bill an item to cover the cost of such instruments.

This resolution was unanimously adopted. Mr. Carl Gayler then read a paper on highway bridge floors, giving several standard designs, with their weights and cost.

Mr. B. F. Crow read a paper on "Constructive Accounts," showing how the cost of the material and labor required to produce each integral part of a street car is found, by means of labor and material accounts with all the orders. One man does all the work due to this system of accounts for 150 workmen. Blank forms were shown and the method described in detail.

After a general discussion of this paper club adjourned.

THE old marine railway at Hunter's Point, near New York, could handle a vessel of 2,000 tons, and it was many years ago proposed to build three of like capacity at the Brooklyn Navy Yard, where now the large timber dry-dock is in course of construction.



WESTERN NEW YORK ASSOCIATION OF ARCHITECTS.

THE winter meeting of the Western New York State Association of Architects was held in Syracuse, February 7. The attendance was large, and the discussion on the matters considered was spirited and interesting. The morning hours were devoted to the examination of the exhibits of building materials, and at half past two o'clock the meeting was called to order by James G. Cutler, the president of the association, who delivered his annual address. He said that he hoped to see the day when all the architectural societies of the country would be consolidated into one great body, and he hoped that that body would include every reputable architect that could be found. He spoke at length of the rise of architecture, and said, "no good art work in architecture is possible without the highest technical skill on the part of those into whose hands the architect must entrust his design." The address closed with some complimentary allusions to the many schools of architecture.

The reports of the executive committee and of the treasurer were submitted and committees appointed.

Papers were read on "Architectural Education," by Professor C. Francis Osborn, of Cornell University, and on "Sewerage as Connected with Civil Architecture," by Emil Kuichling, C. E., of Rochester. Professor George F. Comfort, Dean of the College of Fine Arts, Syracuse University, made an interesting address on "The Facade of the Cathedral at Florence."

In the evening a banquet was tendered the visiting architects by the Syracuse Association.

At the conclusion of the banquet many toasts were made and the festivities ended with an address by President Cutler, who reviewed briefly the history of the association.

The association comprises these members, and nearly all were at the banquet, with several invited guests: George U. Baxter, Syracuse: Louisa Bethune, Buffalo: Robert A. Bethune, Buffalo; Otto Block, Rochester; Thomas Brit, Utica: E. M. Buell, Syracuse: A. C. Burdett, Buffalo; H. L. Campbell, Buffalo; John Hose, Watertown; I. O. Graham, Elmira; J. P. Johnson, Ogdensburg; W. Foster Kelly, Rochester; Edward A. Kent, Buffalo; D. D. Kieff, Watertown; J. H. Kirby, Syracuse; T. I. Lacy, Binghamton; W. W. Carlin, Buffalo; Charles E. Colton, Syracuse; G. Edwin Cooper, Utica; Charles T. Crandall, Rochester; J. R. Church, Rochester; E. A. Curtis, Fredonia; James G. Cutler, Rochester; Otis Dockstacder, Elmira; Asa L. Merrick, Syracuse; George J. Metzger, Buffalo; J. H. Murling, Buffalo; Thomas Nolan, Rochester; C. Francis Osborne, Ithaca; Charles R. Percival, Buffalo; J. H. Pierce, Elmira; A. A. Porter, Buffalo; O. W. Dryer, Jay Fay, Rochester; John Faulkner, Buffalo; Orlando K. Fort, Rochester; Fred H. Gouge, Utica; J.W. Griffin, Watertown; Ellis G. Hall, Syracuse; J. R. Porter, Buffalo: James A. Randall, Syracuse: W. H. Richardson, Rochester; Lewis P. Rodgers, Rochester; William H. Walker, Rochester; W. S. Wicks, Buffalo.

BOSTON SOCIETY OF CIVIL ENGINEERS.

The regular monthly meeting of the Boston Society Civil Engineers was held at its rooms on February 15, President L. Frederick Rice in the chair. A paper on the "Sewage Disposal at Medfield, Mass.," was read by Mr. Fred. Brooks. A paper by Mr. Wilbur F. Learned on the "Chemical Treatment of the Mystic Sewage" was read by him, after which there were remarks by Mr. F. P. Stearns and Mr. Ch. H. Swan. Meeting adjourned at 10 P. M. Thirty-eight members and seven visitors present.

STREET-CAR RAILS IN NEW YORK.

THE conference held at the Mayor's office between the Committee of the New York Chamber of Commerce, the Truckmen's Association, and the presidents of the various street roads resulted in little more than making apparent the fact that the street railroad companies were not disposed to make any changes in the present form of rails at their own cost. In other words, they will do no more than they are compelled to do towards securing better pavements in this city.

J. Reese, of Pittsburg, has patented a set of rolls, arranged to reroll old T-rails directly into small I-beams.

ENGINEERS' SOCIETY OF WESTERN PENN-SYLVANIA.

THE eighth annual meeting was held at Pittsburg, January 17, 1888. President Dempster, Directors Taylor, Hunt, Scaife and Phillips, and 47 members were present and 3 visitors.

Treasurer A. E. Frost reported: Balance on hand, January 7, 1887, \$425.97; amount received in 1887, \$1,469.50: total, \$1,895.47. Expenditures in 1887, \$1,733.78. Balance on hand, \$161.69.

Secretary S. M. Wickersham reported: Number of members January 7, 1887, 304; admitted in 1887, 39; total, 343. Resignations, etc., 13. Members on roll January 7, 1888, 330.

Ten regular meetings were held during the year, which were attended by 322 members and 18 visitors.

F. C. Phillips reported for the Library Committee, and the retiring President read an address, of which the following is an abstract:

To the Members of the Engineers' Society of Western Pennsylvania.

GENTLEMEN: Another year's experience has been added to the history of our society, and although it may not be classified as a "red-letter" year, the attendance, which is a good indicator of the health and vigor of the society, has shown a marked improvement over that of '86. This is, however, not yet what it should be, nor what it could be, if a little effort was put forth by the members.

The zeal of the older members is inspiring to new ones, and promotes life and activity in the whole. Let it, therefore, be the aim and ambition of every member to stir up the latent fires of enthusiasm, shake off the apparent lassitude, and determine that the coming year shall show such a change for the better that will form a cause of pleasure at the next annual meeting.

We note with pleasure the change that the committee in charge made at the first of April in our "meeting place," where arrangements have been made to remain until April, 1890. In these comfortable and easily accessible rooms, it should not require very much solicitation to attract the members to visit them frequently.

The library, under the care of the committee and the untiring labor of its chairman, has been placed on such a basis that there is no difficulty in procuring the information that its pages contain.

The financial status of the society is "normal"—we have not been in debt and do not intend to be. The report of the treasurer exhibits a satisfactory condition.

The number of papers presented and read during the year has shown a betterment over last year. We hope a further improvement may be realized in the coming year.

further improvement may be realized in the coming year.

The cultivation of "social intercourse" among the members has not been attended to as fully as it should be. Becoming "personally acquainted" is a great aid to the development of the aims of the society.

Our "standing committees" seemed to have been impressed with the idea that the word "standing" expressed the whole duty of the committee, and as a result they have not moved officially during the whole year. The true meaning of the word is to let all else remain standing but the work of the committee, and it should be so understood.

In conclusion, let each member feel that this is his society, in the prosperity of which he is individually interested, and show his zeal by his works in promoting its success.

According to your ability, let your light shine through the papers and discussions of the coming year, reflecting credit on yourselves, honor on the society, conferring a blessing on the community, and thus affording cause of real pleasure to your retiring President,

ALEX. DEMPSTER.

The following-named persons were elected unanimously to serve until January 15, 1889: as President, Alexander Dempster; as Vice-President (two years), W. L. Scaife as Directors (two years), T. P. Roberts, Chas. Davis; as Secretary, S. M. Wickersham; as Treasurer, A. E. Frost.

After the election, a paper, by Thos. J. Bray, was read on "Welded Steel Tubes," of which an abstract was given in our issue of February 4.

THE third annual meeting of the Association of Provincial Land Surveyors of Ontario will be held in Shaftesbury Hall, Toronto, Ontario, on February 28, 29, and March 1. The routine business of the association will be transacted and numerous papers on interesting subjects will be read and discussed.

THE UNIVERSAL EXPOSITION AT BAR. CELONA.

THE exposition of agriculture, industries, and fine arts, open to all countries, will be inaugurated at Barcelona, April 8, 1888, to continue for from six to ten months. This exposition has long been delayed by lack o' Government support, but the organization committee has now been at work two years, and last January the Spanish Government, pressed by public opinion, appropriated 2,000,000 francs for the purpose, and all the States of Europe and America were invited to participate. The plan of the grounds, containing 300,000 square metres of building and 350,000 square metres of open ground, embracing the park and gardens of the ancient citadel, is very irregular. The principal buildings are built to remain per-The most important is the Palace of Industry. manently. composed of 12 rectangular sections 21m. wide by 100m. long, which, alternating with 10 triangular ones having a base of 24m., form with an enlarged rectangular section or central pavilion a semi-circular structure whose inner radius is 84m, and the outer one 174m. Around its inner circumference runs a semi-circular hall 34m, wide, whose galleries communicate with every part of the structure, which covers 50,000 square metres. The Palace of Fine Arts, built of brick and iron, is a rectangle, soxioom, with a grand concert hall in the centre having double galleries 10m. wide. Machinery Hall is almost entirely of iron, 60x150m.; 4,000 square metres of its space is reserved for steam-engines and special machines. The charge for space for exhibits is 50 francs per square metre, except in the central galleries where it is 25 per cent. more and for machinery 4 per cent. less. Exhibitors requiring motive-power must apply three months before the opening of the exposition. The official participation of most of the European States has been assured.-Le Genie Civil.

WILLIAM C. KELLEY.

WILLIAM C. KELLEY, the reputed inventor of the Bessemer process of making steel, died at Louisville, Ky., February 12. The deceased was born in Pittsburg, Pa., in 1810, but when quite a young man married and moved to Lyon county, Ky., where he resided a number of years. He engaged in the iron trade and built one of the largest furnaces in the West.

PERSONAL.

FRANCIS LANDEY PATON, D.D., LL.D., has been elected President of the College of New Jersey, at Princton, N. J., to succeed Dr. James McCosh.

CHARLES H. CALDWELL, late of Albany, N. Y., has moved to Boston, Mass., and may be addressed care Messrs. Shipley, Rutan & Coolidge, 13 Exchange Street.

HEALTH COMMISSIONER GRIFFIN, of Brooklyn, has appointed Dr. R. C. Baker Secretary, in place of Dr. J. S. Young, who was lately promoted to be Deputy Commissioner.

DANA C. BARBER, C. E., has resigned his position in the office of the Engineer Commissioner of the District of Columbia, and has resumed the practice of his profession as a Civil and Sanitary Engineer in Washington, D. C.

SHIPLEY, RUTAN & COOLIDGE, architects, have removed their office (formerly office of H. H. Richardson) from Brookline, Mass., to 13 Exchange Street, Boston. Mass. The St. Louis office still remains at the old address. 417 Olive Street.

MR. THOMAS F. ROWLAND is very much improved in health, a stay at Lakewood, N. J., having proved most beneficial. He anticipates spending the remainder of the winter and early spring in the South and expects soon to resume active work.

MR. J. M. JOHNSON has been made Chief Engineer of the Louisville Bridge and Iron Company at Louisville, Ky., filling the vacancy created by the death of Mr. Gilman Trafton, which occurred about a year ago. Mr. Johnson had served as assistant to Mr. Trafton.

MR. B. MONTFORD has been made Chief Engineer of the Louisville and Nashville Railroad Company. The company has not had a chief engineer since Mr. De Funiah resigned five years ago, since which time Mr. Montford has been resident engineer and the late Mr. F. W. Naughn consulting engineer.

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CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

RCHITECTURAL COMPETITIONS.

TARBORO, N. C.—Plans are wanted here or a new jail. Address the County Clerk.

SUMMERVILLE, MASS.—Plans are wanted ere for a Masonic Temple. Address the ecretary of the local lodge.

THE UNITED STATES TRUST BUILDING.

Architect R. W. Gibson, of Albany, has accived the commission for the new United tates Trust Company building, at 45 and 47 vall Street, New York. As yet few of the etails of the new structure have been decided pon.

A \$250,000 OFFICE BUILDING.

Austin Corbin is to erect an eight-story office uilding on the northeast corner of Broadway and John Street, New York, the cost of which ill be \$250,000. Architect Stephen D. Hatch as prepared the plans.

PLANS FOR AN APARTMENT HOUSE.

A new apartment house, to cover a plot 10x116 feet, seven stories high, is to be rected on the site of Holbrook Hall, corner f Sixty-second Street and Park Avenue. 4cKim, Mead & White, architects, are prearing the plans for the new structure.

FORT WORTH, TEX.—Plans are wanted or a large building for the Fort Worth Board f Trade. Dimensions, 75x100; six stories. The cost is not to exceed \$86,500. Address shape



for works for which proposals are requested see also the "Proposal Column," pages i-v-vi-vii-192.

Persons who make any use of the information they ind in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Jurraders will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

FRENCHTOWN, N. J.—L. D. Hagerman, he Town Clerk of this place, writes us under late of February 11, as follows: "At the last nunicipal election held in April, 1887, the juestion of 'better fire protection' was left to copular vote and was carried affirmatively by an overwhelming majority. The Council have juring the summer and fall employed a competent civil engineer, Professor H. C. Landon, who has been prospecting for the most available and economical method of water-supply. Several methods have been advanced, but none have been adopted as yet."

AUSTIN, TEX.—Concerning the reported ewerage project here, our correspondent writes as follows: "There is no proposition of the kind you name now pending in this ity."

AUTAUGAVILLE, ALA.—Our correspondent rites as follows: "Messrs. Smith & Muir, of his place, are putting in water-works to supply the town from a bold spring one mile disant from the town. The work is in operation and will be completed in twenty days."

ROCKDALE, TEX.—The City Clerk writes as follows concerning the water-works procet here: "The City Council as yet has done acthing toward establishing water-works. We have a Business Men's Association in our city hat speak of taking this matter in hand, but so far there is no matured plan."

RANDOLPH, MASS.—Concerning a circulated report that water-works were to be established here, we have received the following from the town clerk: "We have a system of water-works just completed."

PONTIAC, MICH.—The City Clerk of this place writes as follows: "The contract for water-works construction in our city has been

let to Shanley, Kelly & Parker, New York City. Work will be commenced as soon as ground opens."

READING, PA.—The question of improving the water-works system of this city is being considered by the officials. At the request of the Common Council, E. F. Smith, C. E., has made a complete investigation of the matter and has presented a report, together with plans, specifications, and estimates of the cost of the work. Mr. Smith, in his report, favors procuring a supply of water from Maiden Creek and maintains that it is the only feasible source for a sufficient supply for the growing demands of the city. He estimates the entire cost at \$165,944, which includes a first-class pumping engine, of a capacity of 3.000,000 gallons daily, and mains capable of delivering 8,000,000 gallons daily to the northern section of the city, to the connection of the Bernhart and other mains, thus allowing for future increase of pumpage. An analysis of the Tulpehocken, Schuylkill, and Maiden Creek waters, together with his opinions and conclusions upon each, and his recommendation as to the best supply to adopt, was prepared by Albert R. Leeds. Professor of Chemistry in the Stevens Institute of Technology, at Hoboken, N. J., some time ago. Both reports were referred to the Board of Health, with a request that that body should also prepare a report embodying its recommendation as to the best of the various proposed sources of supply from a sanitary standpoint.

MARBLEHEAD, MASS.—Our correspondent writes: "The matter of extending the waterworks of this town was laid over to the annual meeting of the town, which takes place next month."

MARINE CITY, MICH.—The proposition to bond the city in the sum of \$8,000 to extend the water-works system has been carried. The Common Council have instructed the Mayor and Clerk to negotiate a loan for said bonds, and the work of extending the watermains will be commenced as soon as the weather permits in the spring.

Newburyport, Mass.—The question of establishing a proper sewerage system for this city is being energetically discussed by officials, taxpayers and others, and it is probable that it will be solved at an early day. Numerous schemes to meet the end desired have been presented, but with no apparent success. The press of the city has taken up the matter and has procured opinions on the subject from experts and others. Among others who have made propositions to sewer the city is George H. Norman, the builder of the city's present water-works system.

SOUTH FRAMINGHAM, MASS.—The Framingham I'own Sewerage Committee, which was chosen in November, 1886, reported the estimated cost of the sewerage plan at \$140,000. The matter will be considered further at a town meeting, February 20. Our correspondent writes concerning the project as follows "I have no doubt it will be approved, and that the money will be appropriated to built the works. If it is built it will be after the plan described in the report."

Wheeling, West Va.—The Board of Water Commissioners is considering plans for improving the water-works system, and it is proposed to expend about \$50,000 in the work. Plans for two new reservoirs have already been made, one to contain 1,000,000 gallons, the other 2,000,000 gallons. They are to be heavily lined with brick and cement on clay. The other details of the undertaking are also prov ded for. The President of the Board can give details.

RALEIGH, N. C., has adopted sewerage plans prepared by J. L. Ludlow, C. E., of Winston, N. C., and will invite proposals for constructing the same. Extent, between fifteen and twenty miles. Particulars may be obtained from C. G. Latta, Chairman Sewerage Committee, Raleigh, N. C., or from J. L. Ludlow, C. E., Winston, N. C., engineer in charge.

PADUCAH, KY.—Our correspondent writes: "We have a first-class water-works, stand-pipe system; twenty years' contract from September, 1886."

OSHKOSH, WIS—A movement has been inaugurated by the Common Council towards the purchase of the water-works system by the city. It is probable that this question will be submitted to the people at the spring election.

GORDONSVILLE, VA.—Our correspondent writes, under date February 15, as follows: "A bill is now before the Legislature authorizing the town to issue \$10,000 in bonds for the purpose of constructing water-works; will pass this week. The water will be brought in 6-inch pipe between 1½ and two miles from a spring."

IRONDALE, ALA.—It is reported that a reservoir is to be erected here.

CAMBRIDGE, IND.—Water-works are contemplated.

LANSINGBURG, N. Y.—It is reported that a new \$25,000 reservoir is to be added to the water-works plant.

WAVERLY, IND.—A water company has been organized here.

MARBLEHEAD, MASS.—An election will be held March 15 to settle the question of bonding the place in the sum of \$20,000 to increase the water-works system.

FARMINGTON, ME.—An old water-works project has revived here, and public meetings are being held to further efforts toward the establishing of a system of water-works. The Town Assessors have the matter in hand.

BRAINTREE, MASS.—The Water Commissioners will soon contract for a full set of water-works machinery. Col. A. C. Drinkwater is at the head of the commission and has full charge of the details.

COLUMBIA, S. C.—The question of building an additional reservoir and making other improvements to the water-works system here is occupying the attention of the Common Council. The estimated cost of the improvements under consideration is about \$12,00. The matter has been laid over for future action. City Engineer D. B. Miller can give particulars

TROY, ALA.—The water-works question is being agitated here. J. M. Henry can give details.

BRIDGES.

PORTLAND, ME.—The Maine Central Railroad will, it is reported, erect eight iron bridges to cost \$50,000.

WEST TROY, N. Y.—"The bridge is to be built by the State officials. The village officers have no control over it, as it spans the Erie Ganal, owned by the State."

OTTAWA. ONT.—Engineers have made surveys for the proposed inter-provincial bridge which is to span the Ottawa. The distance from shore to shore is 700 feet, whilst the whole work of bridge and approaches will be 2,000 It is thought that the three governments, Dominion, Ontario and Quebec, will all grant bonuses, and that the municipalities benefited should also do the like. The estimated cost is \$125,000.

BAY CITY, MICH. — Our correspondent writes: "The bridge question will be submitted to the people at the special election to be held Monday, February 20."

Washington, D. C.—President John A. Shank and others, of the Ohio River Commission, have appeared before the River and Harbor Committee of the House and made an argument in favor of the improvement of the Ohio. The ultimate plan favored by the commission calls for twelve dams, similar to that at Davis Island, between Pittsburg and Wheeling, five of which they want commenced immediately with an appropriation of \$1,000,000, with additional appropriations from year to year, so that the five dams may be finished about the same time. They have also filed a strong protest against the construction of the new passenger bridge at Cincinnati and against unnecessary bridges generally, declaring that 35 per cent. of all the coal lost in transportation is by accidents at bridges.

CADDON, COL.—Address the Bent County Commissioners for details of an iron bridge to be erected over the Arkansas River. ST. PAUL. MINN.—City Engineer Rundlett has called the attention of the City Council to the dangerous condition of the long span of the Wabash Street bridge over the Mississippi. He maintains that it is to be only a matter of time when the bridge will fall. Bids for rebuilding the long span of the bridge will be received.

STEET-WORK AND PAVING.

COLUMBUS, OHIO.—There is to be considerable paving and other street work done here at once. For details address City Clerk Bryan.

GAS AND ELECTRIC-LIGHTING.

Webster City, Iowa.—Gas works are to be established here.

FORT PLAIN, N. Y.—An electric light plant is to be established here.

THOUSAND ISLANDS, N. Y.—An electric light plant is to be established here. For particulars, address F. A. Kenny, Syracuse, N. Y.

BROOKLYN, N. Y.—At a recent meeting of the Common Council, a report was adopted fixing the cost of lighting the city during 1888 the same as existed during the past year, which is, for electricity \$182.50 per lamp and for gas from \$19.80 to \$22 per lamp.

BAY STATE, MASS.—The officials of tais place are considering the question of establishing an electric-light plant. The town clerk can give particulars.

BONDSWELL, MASS.—Boston parties will establish an electric-light plant here.

MUNSON, MASS.—An electric-light plant is to be established here.

THORNDIKE, MASS. — The electric-light question is being agitated here.

GARDNER, MASS.—An electric-light company is to be organized at once.

PALMER. MASS.—This place is to be lighted with electricity by a Boston company.

FORT WORTH, TEX.—Address W. H. Little for details of \$50,000 electric-light plant to be erected here.

SNOWVILLE, VA.—An electric light plant is wanted here.

CHICAGO, II.L.—The People's Electric Light and Water I'ower Company has been incorporated; capital stock, \$200,000; incorporators, Harry M. Packham, Charles W. Weyl, and Charles P. Anderson.

PATERSON, N. J.—The Committee on Lamps, Wells, and Pumps of the Board of Aldermen has decided to add four electric-lights in each ward, but according to the statements of some of the Aldermen the company which has the contract will be unable to furnish them.

BIDS OPENED.

JERSEY CITY, N. J.—The contract for furnishing a high-service pump and two boilers to the Water-Works Department has been awarded to Henry R. Worthington, of New York, for \$30,000.

FORT SMITH. ARK.—Synopsis of bids for material and constructing a general system of sewers in District No. 1, of the city. under plans, etc., by J. W. Nier, Consulting Engineer, of Kansas City, Mo., opened February 7 by the Commissioners of said district, and furnished through the kindness of James P. Bates, City Engineer: Fruin, Bambrick & Co. St. Louis, Mo., \$207,015.07; J. P. Hughes, Fort Worth, Tex., \$101,400; J. J. Everson, Akron, O., \$144.528; Liddle & Everson, Lockport, N. Y., \$161,406; Michael and John Hayes, Springfield, Mo., \$260,405; S. J. Roman and L. W. Head, Fort Smith, Ark., \$214.400; W. A. Doyle, Kalamazoo, Mich., \$161,670; George S. Miller, Council Bluffs, Iowa, \$176,795.

MILWAUKEE, WIS.—The Board of Public Works has awarded the contract for docking the outlet to the flushing tunnel to W. T. Casgrain & Co. for \$3,600.

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GREEN BAY, WIS .- The following bids for constructing iron draw on Walnut Street bridge, over Fox River, were received by P. J. B. Brice, City Clerk, and opened by the J. B. Brice, ..., Council February 9:

Kansas City Bridge and Iron Co., Mis-

Mount Vernon Bridge Co., Ohio, \$10,200.

Minneapolis Bridge Co., Minnesota, \$0,700.

A. Y. Bayne & Co., Minneapolis, Minn.,

Smith Bridge Co., Toledo, Ohio, \$9,890. Wrought Iron Bridge Co., Canton, Ohio, \$9.645.

Massillon Bridge Co., Massillon, O., \$9,800. Wisconsin Bridge Co., Milwaukee, Wis.,

ing Bridge Co., Cleveland, O., \$0,610 Milwaukee Bridge Co., Milwaukee, Wis.,

Plan A. \$9,975.
Milwaukee Bridge Co., Milwaukee, Wis.,

Lane Bridge and Iron Works, Chicago, Ill., Plan No. 1, \$10,950.

Lane Bridge and Iron Works, Chicago, Ill.,

Plan No. 2, \$9,490.

ST. PAUL, MINN .- Synopsis of bids for hotwater heating apparatus for Foundlings' Home, opened February 7 by Thomas A. Prendergast, City Clerk:

gast, City Clerk:
No. 3 twin hot-water boiler, Edward Kelly,
St. Paul, \$4,983. Horizontal tubular boiler,
Edward Kelly, \$5,471; Thomas Davis, St.
Paul, \$5,761.62. According to plans and
specifications, William Rodger & Co., St.
Paul, \$4,882.90; J. P. Anderson, St. Paul,
\$5,400; E. H. Murphy, St. Paul, \$5,870.
According to hidder's plans, bot water, Wm. According to bidder's plans, hot-water, Wm. Rodger & Co., \$3,464.95. Bidder's plans, steam, Wm. Rodger & Co., \$2,704,10.

VERNON, IND.—Synopsis of bids for piers. abutments, truss bridge, trestling, etc., opened February 6, by J. C. Cope, County Auditor, Jennings County: For superstructure, iron, per foot, 160-foot span, the bidders were as per foot, 160-foot span, the bidders were as follows; Columbus Bridge Co., Columbus, O., two bids, \$20.45, and \$19.75; Lomas Bridge and Forge Co., \$20; Motherwell Iron and Steel Co., Logan, O., \$26.90; Indiana Bridge Co., \$19.29; Queen City Forge Co., Cincinnati, O., \$20; Pittsburg Bridge Co., Pittsburg, Pa., \$19.50; Massillon Bridge Co., Milwaukee, Wis., three bids, \$21.72, \$20.50 and \$19: Lane Brothers, Newark, O., two bids, \$25 and \$22.50; Canton Bridge Co., Canton, O., three bids, \$21.72, \$20.50 and \$19.

\$19.
Superstructure, iron, per foot, 80-foot span, the following were the bidders:
Columbus Bridge Co., Columbus, Ohio, three bids, \$14.80, \$12.50 and \$11.50: Lomas Bridge and Forge Co., \$13.35; Motherwell Iron and Steel Co., Logan, Ohio, \$12.50; Indiana Bridge Co., \$12.50; Queen City Forge Co., Cincinnati, Ohio, \$12: Pittsburg Bridge Co., Pittsburg, Ohio, \$15; Massillon Bridge Co., Massillon, Ohio, \$12.50; Milwaukee Bridge Co., Milwaukee, Wis., \$14.25 and \$12.63; Lane Brothers, Newark, Ohio, \$12.50; Canton Bridge Co., Canton, Ohio, \$14.25 and Canton Bridge Co., Canton, Ohio, \$14.25 and \$12.63.

\$12.63.

Howe truss, per foot, 160-foot span, the bidders were: Indiana Bridge Co., \$18; Massillon Bridge Co., Massillon, Ohio, \$21; Smith Bridge Co., Toledo, Ohio, \$20.75; Cusminger & Carter, Osgood, Indiana, \$20.

Howe truss, per fcot, 80-foot span, the bidders were: Indiana Bridge Co., \$11.50; Massillon Bridge Co., \$21; Smith Bridge Co., Toledo, Ohio, \$13.75; Cusminger & Carter

ledo, Ohio, \$13.75; Cusminger & Carter,

Wet excavation, per cubic yard—John J. Forburger, Deputy, Indiana, \$1: Jos. Replinger, North Vernon, Indiana, \$3; Hicks & Holmes, North Vernon, Indiana, \$1.50; Thornton & Brolley, North Vernon, Indiana, 50c.; Hugh Dorsey, North Vernon, Indiana, \$1.25.

\$1.25.
Dry excacation, per cubic yard—John J.
Forburger, 24c.; Joseph Replinger, 75c.;
Hicks & Holmes, 50c.; Thornton & Brolley,
25c.; Hugh Dorsey, 60c.
Masonry, per cubic yard—John J. Forburger, \$4.20; William Fortune, North Vernon,
Indiana, \$8.75; Joseph Ruplinger, \$6.12;
Hicks & Holmes. \$7.50; Thornton & Brolley,
\$7.75; Enos Hege, Indianapolis, Indiana,
\$6.63; Hugh Dorsey, \$7.
Net for total superstructure, iron:
Berlin Bridge Co., East Berlin, Conn., \$6.

Berlin Bridge Co., East Berlin, Conn., \$6,-111; King Iron Bridge Co., Cleveland, Ohio, \$4,203.79 and \$4,505.87; Variety Iron Works, \$4,020; Smith Bridge Co., \$4,180; Columbus Bridge Co., Dayton, Ohio. \$3,920. Net for total superstructure, Howe truss: Daniel Bacon, North Vernon, Ind., \$4,225.65.

Net total for masonry and excavation: John

Net total for masoury and case.

Greer, Seymour, Ind., \$3,600.

The bids for the 283-foot trestle were as follows: Massillon Bridge Co., \$4.35 per foot;

Page 27 260, 26, complete; Canton Daniel Bacon, \$1,260.26, complete; Bridge Co., iron trestle, \$10 per foot.

The following were the awards: Howe truss, 160-foot span and 80-foot span, also net for total superstructure, iron, to the Smith Bridge Wet and dry excavation and masonry, to

John J. Forburger, Deputy, Ind.

TOLEDO, O.—The following is an abstract of bids received for water-pipe by the Trustees of Water-Works, February 7:

29.75	:	Burnagton, N. J
25.83	25.83	The McNeal Pipe and Foundry Co.,
27.50	26.60	The Ohio Fipe Co
27.10	27.10	New Philadelphia Pipe Works Co
27.74	27.34	Lake Shore Foundry,
29 00	28.90	Addyston Pipe and Steel Co.
\$33.00	\$33.00	St. I ouis, Mo
Delivery April 1.	Immediate Delivery.	BIDDERS.

Bidders made no distinction in regard to size. Contract awarded to the Ohio Pipe Co., Columbus, O.

HENDERSON, KY.—Bids for pumps for water-works were opened by the committee cn February 1, and on February 2 the Water Commissioners agreed to recommend to the Common Council the Gordon & Maxwell pump. Recommendations, accompanied with the proposition of the Gordon & Maxwell pump, was reported to the Council and all bids rejected, and committee appointed, with P. Sasseen. Mayor of our city, chairman, to readvertise for pumps.

TOLEDO, OHIO.—The following bids for G. H. Cole, City Clerk, February 5: W. O. Emsberger, Defiance, O., \$1.95 per foot in earth; \$1.95 per foot in rock; Frank Hake, Toledo, O., \$1, \$3.

GOVERNMENT WORK.

NEW YORK CITY.—Synopsis of bids for building 1,000 feet of pile dvke in Canarsie Bav, New York, opened February 15 by S. L. Gillespie, Lieut. Col. of Engineers:

O'Connell & Coffee Brooklyn, N. Y., \$9,-750; Stephen B. Kelly, Brooklyn, N. Y., \$9,870; John D. Walsh, Brooklyn, N. Y.,

\$9.870; John D. Walsh, Brooklyn, N. Y., \$11,170; P. Sanford Ross, Jersey City, N. I., \$12,350; Moses Engle, Brooklyn, N. Y., \$14,500; Geo. E. Richardson, Brooklyn. N. Y., \$13,450; Fearon & Jen's, New York City, \$11,850; Charles H. Edwards, Quincy, Mass., \$12,060; Henry Du Bois Sons, New York City, \$13,900; Thomas Murray, New Brunswick, N. J., \$12,380; Theo. F. Holmes, New York City, \$13,050; Francis H. Smith, New York City, \$15,890.

The contract will probably be awarded to the lowest bidder.

the lowest bidder.

-On the 11th inst. Colonel G. L Gillespie, the United States Engineer, received "Tourist": A. B. Foster, \$4,175; Smith & Townsend, \$3,475; Atlantic Works, \$4,230; Hodge & Lynch, \$3,175. All the bids were rejected as being in excess of the estimate of cost.

NEW ALBANY, IND.—Synopsis of bils for heating, etc., the court-honse and post office, opened February 15: Crooke, Horner & Co, \$4,159 77; Thomas C. Basshor & Co., \$5,171; Bartlett, Hayward & Co., \$5,280; St. Louis Steam Heating and Ventilating Co., \$5,135; S. I. Pope & Co., \$5,579; Chafer & Becker, \$6,206.

DENVER, Col. - Synopsis of bids for iron column, beams, girders, etc., opened February
16, by the Supervising Architect of the Treasury Department. Clarke, Raffen & Co., Chicago, \$12,150; Dearborn Foundry Co., Chicago, \$11,230; Colorado Iron Co., Denver, first and second floors, \$9,000; third story and attic, \$3,500; L. M. Morris, Cleveland, Ohio. \$13.076; Pennsylvania Construction Co., Pittsburg, \$11,142.

MISCELLANEOUS.

HARTINGTON, NEB.—A fire alarm system is to be established in this city.

GRAND RAPIDS, MICH.—The people vote this spring on an \$150,000 Court House, and several business and other buildings are being

Brooklyn, N. Y .-- A condensing beamengine in the jute manufactory of Burnhan & Lyall, located on President Street, between Hoyt and Bond Streets, was wrecked a few days ago, causing a loss of \$5,000 to the owners. The damage is supposed to have been caused by the breaking of the crank-pin traps. The engine is to be repaired at once.

JERSEY CITY, N. J.-Messrs. Ferris & JERSEY CITY, N. J.—Messis. refris & Halladay, water-works contractors, of this place, write us as follows: "The franchise for constructing water-works at Bowling Green, O., was granted us by Council, and ratified by vote of the people on Monday, January 16."

NEW CORPORATIONS.

THE Morgan Park, Washington Heights and ullman Horse Railway Company, Morgan Pullman Horse Railway Company, Morgan Park, Ill Capital stock, \$50,000. Charles P. Silkva, and others, incorporators.

THE Savannah and Fort Valley Railway Company, Savannah, Ga. Capital stock, \$1,000,000. H. B. Hollins and others, incorporators.

THE Fairview Dummy Line, Decatur, Ala. Capital stock, \$30,000. P. H. Flynn and others, incorporators.

THE Euphrat Electric-Railway Cable Company, San Francisco, Cal. Capital stock, \$1,000,000. Edward S. Salmon and others, incorporators.

THE Long Beach Whittier and Los Angeles County Railroad Company, San Francisco, Cal. Capital stock, \$1,500.000. Timothy Hopkins and others, incorporators

THE Ferries and Cliff House Railroad Company, San Francisco, Cal. Capital stock, \$2,500,000. William J. Adams and others, incorporators.

THE Union City Electric Light, Gas, Water-works Company, Strong City, Kan., has been incorporated. Capital stock, \$10,000. W. P. Martin and others, incorporators.

THE Nebraska Individual Gas Company Omaha, to manufacture and sell illuminating and heating gas and gas fixtures. Capital, \$200,000. A. M. Kitchen, C. H. Brown, and others.

THE Safety Automatic Car-Heating Company, Jersey City, N. J.; capital stock, \$100,-000; Lindley Murray, and others, incorpor-

THE Sectional Tunnel Company, New York, N. Y.; capital stock, \$20,000; William McCarty Little, and others, incorporators.

THE Isbell and Iron Mountain Railroad Company, Russellville, Ga.; J. B. Boyd, and others, incorporators.

THE Ellsworth and Limestone Valley Railroad Company, Glen Elder, Kan.; capital stock, \$1,000,000; J. F. Gleason, and others,

THE National Electric Railway Company, Pittsburg, Pa.; capital stock, \$100,000; J. H. Dalzell, and others, incorporators.

THE Julien Electric Traction Company, East Orange, N. J.; capital stock, \$3,000,000; William Bracken, and others, incorporators.

THE Tight Cap Roof and Corrugated Iron Company, Chicago, Ill.; capital stock. \$300,-000; incorporators, A. C. Durbrow, Jr., R. J. Randolph, and others.

THE Berthelet Sidewalk Co., of Milwaukee. Wis., incorporated by C. A. Berthelet, P. J. Foley, and Henry Ullrich. The capital stock is \$40,000, and the object of the company is to manufacture tiles for sidewalks of Portland cement and concrete.

PUBLICATIONS RECEIVED.

TWENTY-FIRST ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS of the City of Waterbury, Conn., to the Court of Common Council for the year ending December 31, 1887. Welton & Bonnett, Engineers.

THIRTEENTH ANNUAL REPORT of the Board of Water Commissioners of the City of Atlanta, Ga. W. G. Richardson, Supt. December 31, 1887.

Building Intelligence,

WE solicit from each and every one of our readen also matton relating to projected buildings is the cality, and should be glad to recore nemarically and should be glad to recore nemarically program and other stems of unterest.

ABBREVIATIONS.—\$ \$\delta_s\$ brown stone; \$\delta_s\$, brick store; \$\delta_s\$ deadl, brown-stone dweller; \$\delta_s\$ brick store; \$\delta_s\$ advectl, brown-stone dweller; \$\delta_s\$ as \$\delta_s\$ to entered; \$\delta_s\$ to entered; \$\delta_s\$ to owner; \$\delta_s\$ architect; \$\delta_s\$ builder; \$\delta_s\$ (as \$\delta_s\$), owner; \$\delta_s\$ architect; \$\delta_s\$ builder; \$\delta_s\$ (as \$\delta_s\$).

NEW YORK.

S e cor 9th av and 103d st, 4 stone tent cost, \$16,000 each; o, Frank Smith; a, Fr Barus.

S s 103d st, 80 e oth av, stone ten; cog \$16,000; o and a, same as last.

Plot bet 96th and 97th sts, 100 w 9th is br and granite coal shed; cost, \$25,000; City of New York; a, G W Birdsall.

N s 47th st, 145 ft w Third av, 6 bk dwell cost, \$75,000, all; o, Angele Mondolía; i Schneider & Herter.

Se cor White and Cortlandt sts, store house; cost \$36,000; o, John M Dodd: a l Naumer.

No 19 Jay st, stone house; cost, \$19.00 o, John H Mohlan; a, Wm. Graul.

519-521 E 86th st, 2 ten; cost, \$28,000, 2]
o, estate Rachael V. Sturges: a. Edw Wer
S s 145th st, 100 ft e 8th av, 2 flat; cos;
\$40,000, all; o, Jac Stinfler; a, E L Angell.

W s 10th av., 51 ft n Little 12th st. store cost, \$20,000: o, Jas Fay; a, G A Schillinger 349 West 36th st, ten; cost. \$20,000; 0. Robert C Winters; a, C A French & Co.

321-327 West 40th st, 4 dwell; cost, kg000, all; o, Charles Gahren; a, Thom & Wi

S s 83d st, 206 ft e First av, 2 dwell; cost \$28,000, all; o, Maria Wickermann; o, Edz N s 78th st. 125 ft e Madison av, 1 dwell

cost, \$22,000; o; Catherine Burke; a, J H S s 60th st, bet First and Second ars, 5

stores; \$15,000, all; o, Samuel B. Durya; a M J Monell.

E s Cypress av, 171 fts E 149th st, 5 dwell: cost; \$11,600, all; o, Mrs Rozata Glacius; a. Geo C Glacius. N w cor Third av and 42d st, 6 bk dwd.

\$12,000, all; a, Geo Rothman; a, Berger &

ALTERATIONS-NEW YORK.

54 Warren st, cost, \$11,000; o, H F Brevoort; a, Jno B Snook & Sons.

56 Warren st; cost, \$10,400; o, J R Brevoort; a, same as last. 21 W 42d st; cost, \$10,000; o, Helena

Rogers; a, J A Remer. 26 Stanton st, bk dwelling; cost, \$10,000.

o, Finkleston & Saloman; a, Herter Bros. 1000 and 1002 Second av, bk flats; total cost, \$10,000; o, Jos J Gleason; a, C (

Buck. 545 Broadway, bk store; cost, \$20,000: 0. Samuel Jusier; a, Samuel A Warner.

BROOKLYN.

S s Atlantic av, 74 e President st. 4 fr stores and dwells; cost, \$8,500 all; o, Mrs S Pioklmann; a C Infanger.

N s Moffat st, 115 w Bushwick av, 6 br tens; cost, \$5,000 each; o, and and b, E Souterlin and F Ames.

S s Moffat at, 79 e Broadway, 9 br tens: cost, \$5,000 each; o, a, and b, same as last.

Se cor Lorimer and Scholes, 7 fr dwells and stores; cost, \$45,500, all; o, John Rueger; 2 David Acker & Son.

S s Berkley pl, 92 w 6th av, 3 br dwells; cost, \$15,000, all; o, H B Lycns; a, W M Coots.

Ns Fulton av, 186 e Rockaway av, 5 M dwells and stores; cost, \$22,500; o, Geo Walker; a, J E Dwyer.

S e cor 9th av and 19th, br car house; cost. ,000; o, Atlantic Ave R R Co; a, Thayer \$25,000; o, A & Robinson.

N s Jefferson av, 100 e Nostrand av, 4 br dwells; cost, \$48,000, all; o, John F Saddington; a, F D Vrooman.

51 Sackett, br dwell; cost, \$9,500; o, Chas F Lawless; a, Geo Damen.

Flatbush av, bet Bergen and 6th av, br dwell and store; cost. \$18,000, o, Mrs H Harte; 2. Wm A Wendell.

35 and 37 Starr, 2 fr dwells; cost, \$0.000. all; o, Henry Miller; a, David Acker & Sons.



BUILDING INTELLIGENCE.

BROOKLYN-, Continued).

Howard av, s w cor Putnam, 3 br dwells and store; cost, \$24,000, all; o, H Grasman; a, not given.

Es Van Siclen av, 100 s Fulton av, 4 fr dwells; cost, \$20,000, all; o, Reeve & Mott; a, Whitlock & Hill.

MISCELLANEOUS.

WHEELING, WEST VA .-- A new city prison is to be erected here. For details, address the City Clerk.

ST. PAUL, MINN .- The Philip Best Brewing Company will erect a \$200,000 building here. For details, address Captain Pabst, of the company.

CHATTANOOGA, TENN.—Corner of Gilmer st and Georgia av; brick and stone church; c, \$60,000; o, St Paul's Catholic Church; a, Croker & Smith, Chattanooga; c, not let.

BALTIMORE, MD.—Orleans nr Asquith, 3 story br bld; o, Catharine Spengemor.

Lanvale, beg cor Myrtle av, 11 3 story br bidgs; o, Joseph M Cone.

Myrtle av, beg at Dolphin, 10 3 story br bldgs; o. Joseph M Cone.

Dolphin av, beg at Myrtle av, 30 3 story br bldgs; o, as above.

Columbia av and Sterrett, 3 story br bldg; o. Wm Schader.

TROY, N. Y.—Cor Div and River, 3 story br bldg; cost, \$6,000; o, S Goggins; a, H P Fielding; b, work not let.

Oakwood Cemetery, stone church and crematory; cost, \$80,000; o, W S Earl; a, Fuller & Wheeler; m, Magill & Nichols; c, Lemowen & Robinson.

ST LOUIS, MO-22d and Morgan sts, 5 adj br dwells; cost, \$10,000; o, Flora Slupsky; b, Kreyer & Harper

BOSTON-2297-2311 Washington, br mercantile; cost. \$55,000; o, John P Robinson estate; a, Bradlee, Winslow & Wetherell; b. Root Bros.

Hammond, cor Warwick, br apartments; cost. \$8,000; o, Paul B Watson; a, same; b, P J Connolly.

Canuth, cor Beale, br dwell; cost, \$8,000; CLF Steadman; a, George H Young; o, C L F Steaumar b, F M Severance.

ST, PAUL, MINN.—Jackson, cor 8th. 4-story br block; cost, \$65,000; o, William Dawson.

8th, cor Temperance, 3-story br block; cost, \$18,000; o, Mr. Walsh.

DETROIT, MICH.—96 Miami, br dwell; cost, \$7,000; o, T W Clawson; a, Donaldson & Meier; b, A Albrecht.

05 Watson, br dwell; cost, \$7,000; o, H P Pulling; a, W G Malcomson; b, J Mc-Martin.

47 Lincoln av, br dwell; cost, \$7,000; o, O Wardell; a, W G Malcomson; b, Topping & Fisher.

39 Piquette, br dwell; cost, \$7,000; o, S F Young; a, Scott & Co; b, J E Boomer.

WHEELING, W. VA .-- Cor Chapin an '23d sts, double br dwell; cost, \$10,000; o and a, E W Wells; b, Klives, Krait & Co.

HARRISBURG, PA.—304-306 Market st, b s and br store and office building; cost, \$15,000; o. C A Breitinger; a, Smith & Warner; b, not decided.

ST. PAUL, MINN .- The Hebrew congregation, Sons of Jacob, are raising funds for a new synagogue, to cost about \$30,000.

WINFIELD, L. 1.—Address Rev. Father Dansenbach for details of \$20,000 church and parochial school to be erected here.

RICHMOND, VA.—A \$150,000 penitentiary is to be erected here.

DLNEY, ILL.—Mrs. Dr. T. W. Lampton will build a \$25,000 residence here.

FILWAUKEE, WIS.—The Philip Best Brewing Co. will erect a \$25,000 brick building on Grand ave.

Mrs. Flint and Mrs. Sexton, of Milwaukee, and Mrs. Chandler, of Waukesha, will build a \$50,000 building for bank and office purposes on Grand ave., near the river.

IANESVILLE, WIS.—A hospital to cost \$200,000 will be erected here.

BUILDING INTELLIGENCE.

MATAWAN, N. J.-An insane asylum, to cost \$185,000, is to be erected here. Address, for details, Dr. McDonald.

PHILADELPHIA. — Our correspondent writes: "The prospects for the building business for the season of 1888 from present indications are exceedingly favorable. ent indications are exceedingly lavorable. Already a number of large operations are being arranged for, and the builders and contractors think the coming will be a season in advance of last year. Among the large structures is an eight-story building of the Girard Life Insurance, Annuity and Trust Co. of Philadelphia, corner of Broad and Chestnut Streets, having a front on Broad Street of or feet and on Chestnut on Broad Street of 95 feet and on Chestnut Street of 100 feet. The fronts will be of Indiana lime stone, the rest being of brick. The building will be heated with steam, lighted by electricity, and rapid elevators will communicate with each floor. The architect is Mr. Addison Hutton of this city. The contract has been awarded for its construction to J. E. & A. L. Pennock, for, it is said, \$340,000, but it is estimated the cost complete will be \$375,000.

"Another building to be erected is a

\$300,000 structure, to be built on the ground formerly occupied by the Temple Theatre, on Chestnut Street, between 7th and 8th Streets. The building will be 101

by 220 feet.
"A number of other large private structures are talked of."

DELEVAN, WIS.—A \$50,000 hotel will be built here by Chicago parties.

Racine County will build a \$40,000 insane asylum.

Vernon County will build a \$35,000 insane asylum.

MARINETTE, WIS.—A \$150,000 saw-mill will be built on Tweedle Island.

PRAIRIE DU CHIEN, WIS.-A \$300,000 addition will be built to the Catholic Col-

TOMAHAWK, WIS.—A \$350,000 lumber mill and dam will be built here by the Tomahawk Land and Boom Co.

MILWAUKEE, WIS.—Chambers st, fr bldg; cost, \$10,000; o, Milwaukee Base-ball Club; a, Ed V Koch & Co; b, open.

Grand av, br entrance to \$200,000 opera house; cost, \$50,000; o, Davidson Bros. Eight buildings less than \$7,000.

CHICAGO, ILL.—At Chicago City Hall, addn for building department and detective quarters; o, City; a, Commissioner of Bldgs Edbrooke.

Wabash av, nr Peck Court, re-erection of Libby Prison, which is to be removed from Richmond, Va; o, stock company; a, Burnham & Root.

487-89 N Clark, alterations in business bldg; cost, \$10,000; o, Elbridge Hanecy; a, Flanders & Zimmerman.

Grand boul and 41st sts, br and brown st house; cost, \$9,000; o, Rev Thomas Hall, son of Dr John Hall, N Y City; a, H B Wheelock.

849-53 W Monroe, 3 br and st dwells; cost, \$20,500; o, F V Newell; a. Sprague & Newell.

2720 Hickory, br and st store and flats: cost, \$15,000; o, Max Wojtalewicz; a, Thiel & Lang.

N Robey and Raymond, br flats; cost, \$8,000; o, Bernhard Mul'er; a, Wm Olha-

Tell place, nr Ashland av, b s flats; cost, \$10,000; o, Jos Pilot; a, same as last.

Milwaukee av, nr North av, br and st flats; cost, \$10,000; o, Niels Hansen; a, same as last.

272-86 Madison, additional story to business block; cost, \$10,000; o, J H. Swart; a, Burling & Whitehouse; b, Jno Mountain.

14-16 S Jefferson, br factory; cost, \$15,-000; o, Henry Witbeck; a, J H Moore; b, C & A Price.

207 S Canal, br factory: cost, \$22 000; o, Warren Springer; a, Addison & Fiedler. 24 buildings costing \$7,000 each

ST. PAUL, MINN.—12-story office building. granite and brick; cost, \$500,000; o, Pioneer Press Co; a, S S Beman, of Chicago.

WINCHENDON, MASS.—St dwell; cost, \$75,000; o, J N White; a, Fuller & De-lano, of Worcester.

BUILDING INTELLIGENCE.

WORCESTER, MASS.—Adams sq, fr dwell; cost, \$7,000; o, F P Snow; a, J W Pat-stone; b, not let.

Main, alteration of fr dwell; cost, \$2,500; o, James Melanery; a, J W Patstone; b,

Cedar, fr dwell; cost, \$10,000; o, S F Dickinson; a, Fuller & Delano; b, not let.

Park, br block; cost, \$25,000; o, H H Houghton; a, Barker & Nourse; b, not let. Pleasant, br block; cost, \$30,000; o, Luther Baker; a, Barker & Nourse; b, not

West Boylson, br block; cost, \$7,000; o, J A Sears; a, Barker & Nourse; b, not let. 3 bldgs costing altogether \$15,000.

SIOUX CITY, IA.—Eighth and Nebraska, First Congregational Church; cost, \$40,000; o, First Congregational Society; a, G G Baldwin; b, not let.

604 Virginia, dwell; cost, \$15,000; o, T Galbraith; a, E W Loft; b, not let.

(Continued on page 192)

PROPOSALS.

(Continued from page viii.)

PROPOSALS FOR

Pumping Machinery.

OFFICE OF THE
DEPARTMENT OF PUBLIC WORKS,
CHICAGO, Feb. 13, 1888.

SEALED PROPOSALS will be received by the city
of Chicago until 11 A M. Saturday, March 31,
1888, for the construction, delivery, and erection upon
and within the foundations, pump wells, etc., to be
provided in the city of Chicago of five engines, together with suitable pumps and the necessary boilers,
all to be fully equipped and complete for constant
daily use in connection with the city water supply,
according to specifications on file in the office of the
Commissioner of Ruildings.
Proposals must be made out upon blanks furnished
at said office, and be addressed to said department, indorsed "Proposals for Pumping Machinery." and be
accompanied with \$2,000 in money or a certified check
for the same amount on some responsible bank doing
business in the city of Chicago and made payable to
the order of the Commissioner of Public Works.
The Commissioner of Public Works reserves the
right to reject all bids.
No proposal will be considered unless the party

the order of the Commissioner of Public Works reserves the right to reject at y or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm with their address.

GEO. B. SWIFF.

Commissioner of Public Works.

IRON BRIDGE.—Proposals are wanted at Boston, Mass., until February 24 for building and erecting an iron bridge over the railroad at Wood Island Park. Address the City Engineer.

, BROKEN STONE, ETC.—Proposals are wanted at Washington, D. C., until February 23, for piles, lumber, sand, pebbles and broken stone for reservoir outlet, Potomac River improvement. Address Peter C. Hains, Lieutenant-Colonel of Engineers.

BRIDGE.—Proposals are wanted at Bloomfield, Fla., for building an iron draw bridge across the Ocklawaha River. No date specified. Address the County Commissioners.

I.UMBER.—Proposals are wanted at Galveston, Tex., until February 25, for about 500 M, feet of best quality yellow pine lumber, according to specifications. Address B. Adove.

JAIL.—Proposals are wanted at Lawrenceville, Ga., .til March 21, for building a stone jail. Address J.

FI.AGSTONES, ETC.—Proposals are wanted at Baltimore, Md., until February 27, for furnishing flag-stones, Belgian blocks, cooblestones, iron gutter plates, and sand, to be consumed in repairs to streets, etc., during the year 1888. Address A. E. Smyrk, City Commissioner.

JAIL.—Proposals are wanted at Knoxville, Ga., until March 6, for building a brick jail. Address B Le Sueur.

ELECTRIC TIGHTS.—Proposals are wanted at South Boston, Va., for the building of an electric-light plant. No date specified. Address Joseph Stebbins.

ELECTRIC LIGHTING.—Proposals are wanted at Milwaukee, Wis., for lighting the court-house, county jail and House of Correction by electricity. No date specified. Address the County Committee on Public Buildings.

BUILDING.—Proposals are wanted at Yankton, Dakota, until March 27, for building additional wings to the insane hospital. Address the Building Com-mittee, Yankton Savings Bank, that city.

PLUMBING.--Proposals are wanted at Washington, D. C., unt I March 2, for the labor and materials required in the erection of the plumbing and gas-fitting required for the post-office, etc., at Terre Haute, Ind. Address Will. A. Freret, Supervising Architect.

SEWERS.—Proposals are wanted at Washington, D. C., until February 23, for constructing t2 to 20 inch terra-cotta pipe sewers in certain streets. Address Charles W. Raymond, Major of Engineers, Commissioners, D. C.

PROPOSALS.

PROPOSALS.

Louisville Water-Works.

TO CONTRACTORS.—Sealed proposals, addressed to the President and Directors of the Louisville Water Co., and endorsed "Proposal for Fulloring Inlet and River Work," will be received at the office of said company, 540 Third Street, Louisville, Ky., until 12 o'clock M., of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders or their representatives. Bidders are required to state in their proposals, under oath, the names and residences of all the parties interested therein, whether as indiv duals or business firms and companies. Bidders are required, with each proposal submitted, to enclose a certified check in the sum of one thousand (\$1,000) dollars as a forfeit to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying Slank form, in the filling up of which the price must be stated both in written words and figures. Any bid submitted otherwise will be declared informal and rejected. The person or persons to whom the contract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sustets, and execute the contract within six days from the date of lotification that the work has been awarded to him or them, and in case of failure or neglect so to do he or they will be considered as having abandoned it, and as being in default to the Louisville Water Company to the amount of the check deposited with the proposal as liquidated damages. General plans and detailed grawings, with the specifications, can be examined at the Water Company folice, from 9 A. M. to 5 P. M., until the day the bids are opened. Not less than two bondsmen will be required from the party to whom the contract may be awarded, and the amount of the bond shall be \$5,000, for which sum the bondsmen shall be jointly and severally liabe, as a guarantee that the party entring int

to the water Company. The Water Company reserves the right to reject any or all proposals submitted. LOUISVII.LE WATER COMPANY, by Charles R. Long, President.

TO CONTRACTORS.—S aled proposals, addressed to the President and Directors of the Louisville Water Company, and endorsed "Proposal for building Engine-House and Engines Foundations, will be received at the office of said company, 540 Phrid Street, Louisville, Kv., until 12 o'clock M., of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders, or their representatives. B'dders are required to state in their proposals, under oath, the names and residences of all the parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each proposal submitted, to enclose a cert-fied check in the sum of five thousand (\$5,000) dollars, as a forfeit to the Wat r Company in case of a refusal for any reason to promptly enter into a contract and bond, on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filting up of which the price must be stated, both in written words and figures. Any bid submitted otherwise will be declared informal and rejected. The person or persons to whom the contract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sureties, and execute the contract within ix days from the date of notification that the work has been awarded to him or them; and in case of failure or neglect so to do, he or they will be considered as having abandoned it, and as being in default to the Lousville Water Company to the amount of the check deposited with the proposal, as liquidated damages. General Plans and detailed drawings, with the specifications, can be examined at the Water Company's office, from 9 A. M. to 5 P. M., until the day the buds are op ned Not less than four bondsmen will be required from the party to whom the contract runs be finence,

De accept ible to tine water Company reserves the right to reject any or all proposals submitted. LOUISVILLE WATER COM-PANY, by Charles R. Long, Pres. dent.

TO BUILDERS OF PUMPING ENGINES.
—Sealed pri posals, addressed to the President and Directors of the Louisville Water Company, and indorsed Proposal for Pumping Engine, will be received at the office of the Louisville Water Company. No. 549 Third Street, Louisville, Ky., until 12 o'clock M. of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders, or their representatives. Bidders are required to state in their proposals, under oath, the names and res dences of all the parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each proposal submitted, to enclose a certified check in the sum of ten thousand (\$10,000) dollars, as a forfet to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond, on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filling up of whice the price must be stated, both in written words and figures. Any bid submitted otherwise will be declared informal and rejected. Tree persons to whom the co. tract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sureties, and execute the contract within six days from date of notification that the work has been awarded to him or them; and in case of faiure or neglect so to do, he or they will be considered as having abandoned it, and as being in default to the Louisville Water Company's office, with acceptable to the Louisville water Company to the amount of the bond same opened. Not less than five bondsmen will be required from the party to whom the contract may be awarded; and the amount of the bond shall be \$100,000, for which sum the bondsmen shall be jointly and severally liable, as a puarantee that the party entering into a co serves the right to reject any or all proposals submitted. LOUISVILLE WATER COMPANY, by Charles R. Long, President.

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BUILDING INTELLIGENCE.

PROVIDENCE. R. I.—Peace, br school house; cost, \$50,000; o, City of Providence; b, F Mason, J F Pitts.

8 buildings costing less than \$7,000 each.

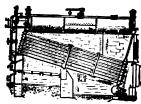
PHILADELPHIA, PA.—Tasker, bet Broad and Tiernan, 4 3-story dwells; b, James H Hamilton.

Ritchel and Green la, 3-story dwell; b, Frank Gillet.

ALLEGHENY, PA.—Nothing over \$7,000 in value to report.

PULLMAN, ILL.—Br and st church; cost, \$20,000; o, Lutheran Church; a, SS Beman.

"STEAM"



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With One Hundred and Nine Illustrations.

PREFACE.

THE SANITARY ENGINEER, while devoted to Engineering, Architecture, Construction, in Sanitation, has always made a special feature of its departments of Steam and Hot-Water Haing, in which a great variety of questions has been answered and descriptions of the sativations buildings have been given. The favor with which a recent publication from this centitled "Plumbing and House-Drainage Problems," has been received suggested the petition of "Steam-Heating Problems," which, though dealing with another branch of indeen is similar in character. It consists of a selection from the pages of The Sanitary Engineering Construction and answers, besides comments on various problems met with in the designing an construction of steam-heating apparatus, and descriptions of steam-heating work in oxize buildings.

buildings.
It is hoped that this book will prove useful to those who design, construct, and have

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BOILERS.

BOILERS.

On blowing off and filling boilers.
Where a test-guage should be applied to a boiler.
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room.

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A woman's method of regulating a radiator (covering it with a cosey).

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PIPING AND FITTING.

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RAISING WATER AUTOMATICALLY trivance for raising water in high building ticism of the foregoing and description of new device for a similar purpose.

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MISCELLANEOUS.

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Expansion-joints.

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in England (comments by The Sanitary Experiments)

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Steam-heating apparatus in Mutual Life Inspirit Building on Broadway.

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Systems of heating houses in Germany and Austria Steam pipes under New York streets-difference burges are two systems adopted.

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MISCELLANEOUS QUESTIONS.

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Condensation per foot of steam-main when laid aground.

ground.

Oil in boilers from exhaust steam, and methods o

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CITIZENS OF COLORADO ASK NATIONAL AID FOR IRRIGATION.

THE Board of Trade of Greeley, Colorado, have presented a memorial to Congress setting forth that there is much arid land in Colorado belong. ing to the Government which could be rendered fertile by irrigation; that all the summer flow of the mountain streams in many portions of the State has been already appropriated for purposes of irrigation; that frequent fires and domestic and mining requirements are rapidly denuding the mountains of the forests which protect the winter's snow from rapid thaw, thereby adding to the disastrous floods in the Missouri and Mississippi Valleys and diminishing the supply of water when needed for irrigation; that there are many valleys and lakes that can be converted into vast storage reservoirs; that the water used for irrigation percolates back to the natural water-courses, furnishing a new supply to the streams below, or is evaporated and gives rise to many a refreshing rain. They therefore think that, with an extensive system of storage and irrigation, Colorado will greatly add to the watersupply of Kansas and Nebraska, as well as render valuable a vast area of arid Government land in her own borders, and ask Congress to make suitable appropriation to construct a system of reservoirs in Colorado for irrigation purposes, and to reserve for that purpose suitable reservoir sites on the Government land before they are otherwise appropriated, and to provide for the utilization of the water thus stored.

Some citizens of a State that has neglected to protect her forests are now petitioning the general Government to protect them from the consequences of such neglect.

The memorial to Congress of the Board of Trade of Greeley, Col., which we have condensed above, asking for national aid in the matter of irrigation, and setting forth as a prime reason for such aid the rapid destruction of the mountain forests, certainly strongly suggests that it is not only the right, but the duty, of Congress to protect our forests by wise national legislation.

The petitioners plainly state, and, in fact, it is the main ground of their appeal for national aid, that the evils resulting from the destruction of their forests are not confined to their own borders, but extend to neighboring States. This clearly shows that forest preservation should not be left, as in this case, to the caprice or negligence of individual States. It should be made the subject of well-considered and far-reaching Congressional enactment, and that without de-lay, or we shall have no forests left to protect. If there is any doubt about the jurisdiction of Congress in such a case, it can at least repeal the duties on lumber, and to that extent remove the incentive to wield the axe. Paradoxical as it may sound, protection to our lumber is destruction to our forests.

THE TRANSPORTATION OF STRUCTURAL IRON-WORK.

IT will be remembered that the circumstances of the fall of the girders of the Union Elevated Road indicated that they probably failed by simultaneously buckling to one side, which the lack of bracing permitted them to do.

This theory receives incidental confirmation from the testimony at the coroner's inquest of the man who was standing by the hoisting-engine taking in the slack of the rope by which the traveler was being hauled ahead. He said: "I was suddenly swung against the engine and then the whole affair dropped into the street.'

Reference to the illustrations accompanying our description of the accident will show just where he must have been standing, and if the girders failed by buckling, the first movement of the platform would have been nearly horizontal, and in such a direction as to throw the man against the engine, or rather to bring the engine up against him, which would seem to him the same thing.

Another corroborating statement, though not brought out at the inquest, is that of a workman who was looking for a job, and who was an eyewitness of the accident. He was of the opinion that something "caused the girders to buckle."

If, then, we accept the theory of buckling as the probable immediate cause of the disaster, the curvature already described as observable in almost all the unbraced girders will easily explain why they buckled so readily and under such a comparatively light load.

How did these girders come to be so bent? The answer to this question brings us to the point we wish to enforce-namely, the importance of greater care in handling the finished members of metallic structures while in transit. In the bridge-shops they are carefully put to-gether and judiciously handled, and, presumably, properly stowed on cars or lighters when shipped; but whenever, as is almost always the case, transshipment is necessary from cars to lighters, or vice versa, or to the trucks on which they are to be hauled to the place of erection, they are at the mercy of stevedores or riggers, who think no injury short of actual fracture of any consequence.

Long plate-girders, so very strong one way and so very weak the other, are specially liable to suffer at their hands. They do not scruple to lift them on the flat by a sling in the middle, and if the chord angles fortunately escape a crack through the rivet-holes for the sway bracing no amount of permanent set disturbs their consciences. The plate-girder's troubles are not over, however, when it escapes from the hands of the stevedore. The truck on which it is laid or under which it is slung is never long enough to support its whole length. About a third of it usually projects unsupported behind, and the jolts and jars of ill-paved streets frequently put another more or less noticeable kink in it before its journey is completed. Some of the girders on this very work of which we have been speaking were so badly bent that they had to be forcibly straightened before erection.

Now engineers know, as riggers do not, that whenever a bar or a member receives a permanent set it must somewhere have been strained beyond its elastic limit—that is to say, the metal has been subjected to a strain at least double, perhaps much more than double that due to the maximum working load for which it was designed.

This would be bad enough had the strain been uniform in one direction, and sufficient to excite grave doubt as to the safety of using a member that had been so treated. Who, for instance, would accept an eye-bar that, having accidentally been made half an inch too short, had been forcibly stretched to the required length, still less one that had been stretched too long and then upset enough to make it right? Yet in an eye-bar that has been bent and straightened cold the metal at the point affected is in even worse condition. On one side it has been first compressed and than stretched; on the other side the reverse of this, not with a uniform strain, but with all degrees of intensity from the neutral axis out. What chance is there that this metal will all pull together with anything like the efficiency of an uninjured bar?

In a plate-girder that has been similarly treated the injury, owing to its greater complexity of structure, is likely to be even greater, and yet, if it can by any means be forced into its place and held there, the erecter thinks it is all right, and no inspector can thereafter guess what its internal strains may be by any process with which we are acquainted.

It is to cover contingencies like these that engineers are obliged to use such expensively large factors of safety. Factors of ignorance at present advisable or permissible we shall not at present discuss, but that the precautions should be taken, we think, admits of no discussion. Had it been done, perhaps some lives might have been saved the other day in Brooklyn.

A WAGON-TIRE FOR STREET-CAR TRACKS.

WE gave last week under this heading in our Novelty column an English invention designed to enable vehicles to get out of the car tracks with less difficulty and danger than is ordinarily experienced in so doing.

That such a device as this should be considered necessary is a forcible commentary on the evils and injury to wagon traffic resulting from the use of certain street rails, and while this invention may serve to lessen the dangers to certain vehicles, the obvious and only right remedy is to remove the cause. As Mayor Hewitt says in his recent message, the centre-bearing rail should go.

In this connection it is of interest to note that a resolu-

In this connection it is of interest to note that a resolution is pending before the Board of Aldermen to compel the removal of the centre-bearing rail from Broadway. blocks diagonally. It strikes us that this would drive many people out of their homes and compel them to live farther away from their occupations, a result doubtless profitable to the street cars, but not to the inhabitants. After all, perhaps, both as regards the time saved in riding, and the energy saved in not walking, everything depends on what you do with the savings."

A SOLDIERS' MONUMENT PROPOSED FOR NEW YORK CITY.

An Aldermanic Committee has recommended the creation of a public fund of \$250,000 in \$100 shares to be called "The Soldiers' Monument Stock of the City of New York," the proceeds to be used as indicated by its name. The Board of Aldermen have decided to adopt the recommendation and have appointed Mayor Hewitt, Controller Myers, Gen. John Newton, General Martin T. McMahon, Jordan L. Mott, Henry Hilton, and President Forster, of the Common Council, a com-



A COUNTRY STORE AT OAK PARK, ILL. -GEORGE H. EDBROOK, CHICAGO, ARCHITECT.

they have well been called, but it is not so much ignorance of the properties of the material as it is ignorance of the amount of misuse and abuse that the material is likely to receive.

The remedy is simple and obvious. The inspection in the interest of the purchaser, which should begin, at least, at the rolling-mill and cease only when the material has been finally erected, should have no such dangerous gap left in it as this period of transit is now permitted to make. Some one should be with the material at all times, at least on all occasions of transshipment, that knows how such material should be handled and has the authority to make his knowledge effective.

We are inclined to believe that if this and similar precautions were always carefully attended to, enough could be safely saved on the weight of the material to amply cover their expense.

Whether such reduction of weight would be

THE ECONOMIC WASTE OF WALKING.

In a lecture recently delivered before the Franklin Institute Prof. Haupt has been astonishing the world by his calculations on the saving to be effected by rapid transit. He calls the results "intensely practical," and insists that the prosperity of a community is fostered by recognizing the facts he discloses. The Electrician says: "We do not feel quite so sure about it ourselves, but our readers can judge. By doubling the velocity of the street cars in Philadelphia half an hour might be saved for each passenger, and a saving of 23,148 years would annually be effected on the aggregate passengers using the cars. At first we were inclined to suggest that the passenger would save his time altogether by not taking the ride. But the curious professor assumes that everybody must ride or walk, and he evidently is dead against walking, a method of locomotion which involves continuous loss of energy, in New York computed at 8,333,333 horse power. To effect a large economy in this item he proposes to erect fresh thoroughfares, cutting through the existing mittee to select a site. It is to be hoped that they will be guided by greater wisdom than was displayed by those who recently selected sites for the new municipal buildings in the same city.

buildings in the same city.

The city furnished 140,000 men to the late war, of which over 12,000 died in the service, and it would certainly seem as if their valor and patriotism deserved some fitting recognition from their mother city.

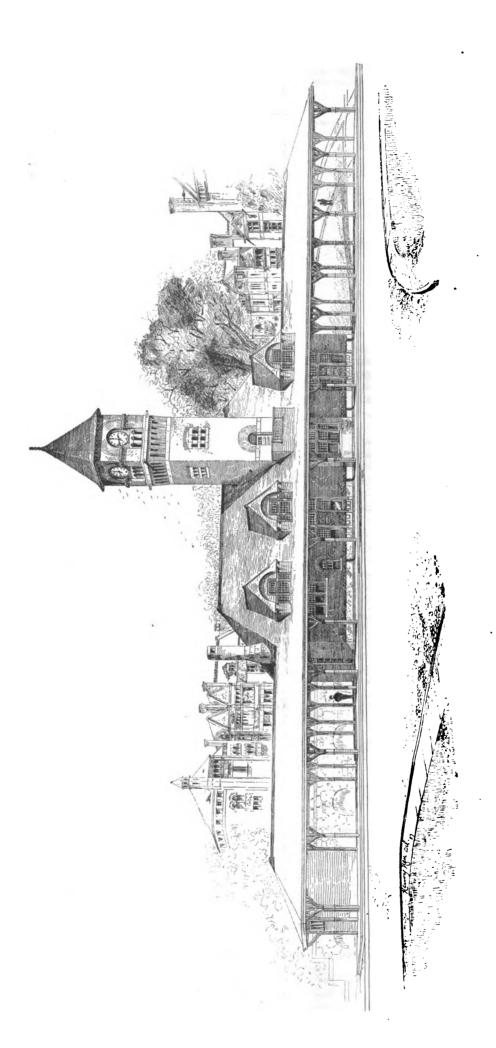
THE HIGH BRIDGE PARK.

THE Park Commissioners of New York City have adopted the plans for this park prepared by Park Super-intendent Parsons and Landscape Architect Vaux. The public will be allowed to inspect and object on March 6.

OUR ARCHITECTURAL ILLUSTRATIONS.
RAILROAD DEPOT AT WALTHAM, MASS.—HARTWELL &
RICHARDSON, ARCHITECTS.

A COUNTRY STORE AT OAK PARK, ILL.—GEORGE H.
EDBROOK, ARCAITECT.





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

RAILWAY DEPOT AT WALTHAM, MASS.

HARTWELL & RICHARDSON, ARCHITEC

THE ARCHITECTS' OBJECT TO THE PRO-POSED COMPETITION FOR THE NEW MUNICIPAL BUILDINGS IN NEW YORK CITY.

THE New York Chapter of the American Institute of Architects object to the site selected for the proposed municipal buildings in that city, but, if that is irrevocably fixed, ask that the following changes be made in the mode of competition:

First.—That the manner of grouping the buildings and the planning and distribution of the rooms be left to the competitors, limited only by the specified requirements of space for the various departments, etc., to be accommodated.

modated.

Second.—That disinterested professional experts, who should be architects of acknowledged ability, experience and standing, should be appointed, to whom all the plans would be referred for analysis and classification, and who would make a detailed report to the commission for their consideration with recommendations as to the award of premiums and choice of plans.

Third.—That the successful competitor should be appointed architect of the building, provided that in case he should not be, in the judgment of said experts and commission, a person of sufficient artistic, or constructive or administrative capacity, then there shall be appointed an associate or consulting architect, so qualified, whose compensation shall be deducted in equitable proportion from that of the architect.

The protest of the Architectural League, presented to the Mayor by a committee of the league, consisting of J. Beverly Robinson, Frank A. Wright, A. II. Thorp, William B. Tuthill and Frank Waller, is made in a general way against the terms of the competition, and says: "In our judgment a competition of such magnitude demands careful preliminary consideration at the hands of professional advisers of known ability, and we respectfully urge that the terms be modified through such agency even at this late day. It is only by such action that men of acknowledged reputation commensurate with the dignity and importance of the municipality can be secured as competitors."

Neither of the architectural bodies nor its individual members believe that Mayor Hewitt's plans will be carried out, and they almost unanimously believe that the Legislature will step in to interfere.

The New York Times in commenting on the matter says:

"The remonstrance of the architects against the procedure adopted by the Commissioners of the Sinking Fund in relation to new municipal buildings is unnecessary, except for the future admonition of that body. The project is already dead. It was evicently an attempt to evade the law, and was thus of questionable legality, while it was of unquestionable absurdity. Any architect could have told the commissioners that their plan was impracticable and ridiculous, and thus saved them from the mortification of baving their blunders so exposed in the public prints that they have not attempted to defend them, while the Mayor has made some ineffectual attempts te disown them. Next time they will doubtless show more deference to the statute empowering them to build than they did this time, and they will also be likely to take the opinion of some reputable architect before, instead of after, adopting and promulgating a plan 'out of their own heads.'"

THE Congressional House Committee on Commerce has decided to report favorably the bill to charter the Nicaragua Canal Company. The bill, as amended, will require a majority of the directors of the company to be American citizens, and the president of the company to be a civizen and resident of the United States.

PAVEMENTS AND STREET RAILROADS.

No. XXVIII.

(Continued from page 150.)

ASPHALT AND OTHER PAVEMENTS IN THE CITY OF LONDON.

A SEPARATE report was made this year on asphalt pavements. The tests of thickness by pieces cut out, weighed for compressed asphalt from about 16½ to 22 pounds per square foot; the original thickness being about 2 to $2\frac{1}{2}$ inches and reduced thickness $\frac{1}{16}$ to $\frac{3}{2}$ of an inch less. It would seem to indicate less care in compression in some cases than in others.

In 1874 a patent "asphalt" pavement, consisting of tar, cement, sand, and sawdust, laid 2½ inches thick while hot under a pressure of 112 pounds per square inch on concrete foundation, was tried, and taken up in two months.

Another, called a metallic asphalt, consisting of blocks 2x2 feet and 4 inches thick, made up of manufactured "asphalt" and burnt ballast, also failed in the same time.

This year the "Court of Common Council" resolved, "That in their opinion tramways in the City' of London will occasion greater inconvenience to the general public and to the traffic within the city than they will conduce to the convenience of the public."

A special report made this year on asphalt and wood pavements gives conclusions as follows: Asphalt is less noisy than granite and wood less than asphalt. Asphalt needs close attention to repairs or is speedily knocked to pieces. Wood is in time unequally worn, and causes more jolting and noise than when new; disturbing those inside of carriages, however, the most. Large blocks with wide joints wear more unequally than small blocks with close joints. Asphalt is smoother, cleaner, and drier. Water remains longer on wood and dirt remains in the joints. The smell mentioned in connection with wood has caused no complaints, and, on the contrary, people living on line of streets paved with it are anxious to have it continued. Asphalt is most pleasing to the eye, and, on the whole, most pleasant to travel upon. Both should be kept perfectly clean, but this is most difficult with wood. Washing is the best method for all pavements. This makes asphalt slippery, but does not affect wood. One can be laid about as fast as the other. In good weather 125 to 120 yards laid per day. Asphalt is easily repaired and wood less so, and not so permanently.

As to slipperiness, it was found in Paris that I horse in I,308 slipped on granite, and I in I,409 on asphalt. An extended series of observations for fifty days in London, with weather mostly dry and cold, the asphalt sanded, when wet, gave one fall for each horse traveling 191 miles on asphalt and 330 on wood. On wet days this became respectively 192 and 432 miles. The complete falls were in the ratio of about I wood to 4 asphalt. The wood gives more chance to the horse to save himself, while a small quantity of mud makes asphalt very slippery. It is more difficult for the same reason for a horse to get up from the latter.

Wood, on the contrary, seems to be more slippery when frost and snow prevail. It is not so safe at ordinary times to drive fast on asphalt as on wood; and a horse can be stopped quicker on the latter, except in frost.

Compressed asphalt in all cases proved more durable than other asphalts. The opinion is expressed that no asphalt will last more than four to six years without much repairs, and that their entire surface must be renewed in from six to ten years. The cost reported on eight compressed asphalts at the date of the report for whole cost and maintenance for the seventeen-year term was, per year, from 1s. 4½d. to 2s. 4½d., the average being 1s. 8d.

At the same date wood pavements were reported, under a heavy traffic, as lasting 9 to 11½ years, the total surface having been relaid at least once, and additional blocks inserted from time to time, the mean total cost per annum being 2s. $7\frac{1}{2}d$. for those under heaviest traffic and 2s. $4\frac{1}{2}d$. for lighter traffic.

In 1875 Ludgate Circus was completed, giving a diameter of 160 feet, and greatly relieving the consequent traffic at that point.

A large number of patent wood pavements laid down for experiment, replacing granite blocks.

Cleansing of the footways begun by the Commission in 1872 was continued, and a method of sprinkling streets by means of perforated pipes laid along the curbs put in operation as an experiment.

The slipperiness of asphalt had become a subject of complaint, and sand recommended as a remedy, sparingly used

In 1876 the granite sets with "asphalt" joints, laid three years before, were found to be in very bad condition, as it was impracticable to remove blocks for repairs without considerable expense, the smallest repair requiring a boiler and special heating apparatus. The pavement was a noisy one also.

The apparatus for removing snow by melting was used, and the cost of melting a cubic yard found to be $11\frac{1}{2}d$, 192 feet or gas melting one yard. Salt was then used, and then forced towards the gullies by hand labor.

This year another patent apparatus for washing streets from pipes along the centre was put in place for trial.

A number of new "resting-places," or refuges for pedestrians in crossing public streets, were constructed. This very desirable improvement is worthy of imitation in many of our crowded cities.

In 1877 another of the patent pavements, called "Barnett's iron asphalt," proved a failure, and the company threw up its contracts for maintenance.

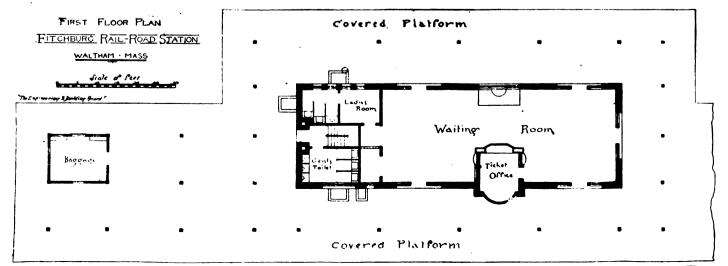
The compressed asphalt seemed steadily growing in

This year a pavement of blocks composed of clay highly compressed and hard-burned was laid. The blocks were 3½x8 inches and 6 inches deep, weighing 12 pounds. These were laid on "ordinary ballast," with ¼-inch joints filled with ballast. The removal of granite block pavements continued.

The use of salt on the streets for removing snow ("coupled with quick and careful sweeping so soon as the salt has done its work") was continued as the most effective means.

In 1879 Davison's patent iron and asphalt pavement was laid, consisting of iron frames with projecting iron studs, set in mastic asphalt on a concrete foundation. A similar one with lead disks proved a failure in three months. Up to this date thirteen kinds of asphalt pavements and eleven of wood had been laid, so that nearly every portion of the great arterial thoroughfares were paved with one of these.

In 1880 the iron and asphalt pavement and one of the mastic asphalts proved failures, also a "noiseless granite" pavement laid on felt, etc.



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This year was laid a sidewalk pavement consisting of slabs made of pulverized granite sifted to the fineness of sand, mixed with Portland cement and water, and, after setting, dipped in a silicate of soda. A nuisance of steam disharged into sewers, and escaping into streets, etc., was abated by the Commission forcing the construction of a special sewer by the offenders.

In 1880 another subway for pipes, etc., was constructed by parties owning property on each side of a newly-opened street. A specimen of the so-called granolithic pavement, made of crushed granite and lime or cement, was laid. Wood and asphalt had now almost entirely replaced granite in the main thoroughfares and many of the minor streets, asphalt predominating. Three more "resting-places" were introduced.

The construction of subways was again forcibly urged as the only means by which to prevent tearing up of the streets.

In 1882 the washing of streets by a hose and jets having been in use two years was reported upon favorably. In the same year a special report gives the annual cost of maintenance only of various pavements as follows:

The average for 16 of Val de Travers compressed asphalt was 1s. per yard; of 7 Limmer compressed asphalt, $9\frac{1}{2}d$.; of 5 Sociéte Francais des Asphalte's compressed asphalt, 11d.; of 9 improved wood, $12\frac{1}{2}d$.; of 18 of all kinds of wood, $13\frac{1}{3}d$.; and of 5 granite block, $5\frac{1}{2}d$.

In 1883, the report states that "the most favorable period for using water (for cleansing streets) is when the surfaces of the wood and asphalt are in a moist and greasy condition," the mud being then most easily removed. Street washing was done on 187 nights.

In 1884 the so-called International pavement, consisting of large blocks of asphaltum and crushed limestone, highly compressed, and laid on a concrete foundation, of which a specimen was laid three years before, proved a failure. The Asphaltic Wood Pavement Company also failed. The large amount of sand required on the asphalt pavements and the removal of the mud formed is reported as requiring 50 per cent. more laborers to care for the streets.

In 1885 complaints were made of smell arising from a wood pavement. The street was one on which the sun rarely shines, and not being well adapted for wood, it was replaced by asphalt. The Henson Wood Paving Company failed.

In 1886 the engineer reports all the wood pavement companies as either bankrupts or as having failed to fulfill their contracts but three.

This ends the list of reports received to the present time. There are many other matters treated in them; and being the summary of the experience of such a dense population, the results are especially valuable to city engineers everywhere.

REINFORCED WATER-PIPE BELLS.

THE first pipe of the duplicate main which is to supply water from Lintrathen Loch to Dundee has just been laid. The jointing of the old pipes was on the turnedand-bored principle; but Mr. J. Watson, the engineer, is of opinion that this system tends to make the line of pipe too rigid, and does not leave it free to yield to fluctuations in the temperature of the water. In the new pipes the sockets are to be dovetailed inside, and the spigots placed freely in and calked with lead. Over each socket a steel hoop is then shrunk. In order to ascertain the value of the respective methods of jointing, Mr. Watson had a series of experiments carried out at the foundry in Glasgow where the pipes are produced. It was found, as the results of these experiments, that the unhooped pipe burst at a tensile strain of 18,885 lbs. to the square inch; while the hooped pipe did not burst till the pressure was 26,677 lbs. to the square inch-showing an advantage of 41.2 per cent. derived from the steel hoop. In the case of the unhooped pipe, too, it was observed that the fractured part was forced altogether out; but that in the case of the hooped pipe the cast iron was only fractured, the hoop remaining intact, and preserving the pipe in a more serviceable condition than the other—thereby limiting very much the amount of water which would escape. The new pipes are from 1 to 1¾ inches thick.—Journal of Gas-Lighting.

On the Midland Railway in England, adhesion of locomotives is promoted by the use of a very fine jet of sharp sand blown under the tread of the wheel by a blast of compressed air or steam. In France water has been used for the same purpose with good effect.

WOODEN WATER-PIPES IN COLORADO.

THE water-works company, of Denver, Col., is now laying wooden water-mains in certain localities which at present are so thinly settled as not to warrant the expense of iron-pipes. While the use of "temporary" construction in place of permanent work is not usually to be recommended, even at a considerable saving in first cost, there sometimes are places where, owing to the cost of transportation, or other difficulties, or the smallness of the revenue to be derived, the question is not between cheap work and good work, but between cheap work or none. We, therefore, present the details of the Denver system, whose advantages are: Small first cost; rapidity and cheapness in construction, requiring no skilled labor; facility in transportation, the component parts being small and light; sufficient strength and reasonable durability.

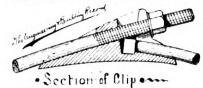
As the illustrations show, the pipe is formed of staves similar to those of a barrel, which are hooped together by

THE COLORADO WOODEN WATER PIPE



round iron bars. The ends of each hoop are held in a cast-iron clip or socket, one end having a T-head and the other being threaded to furnish means of tightening. The staves are about 3½ inches wide, of any

THE COLORADO WOODEN WATER PIPE



convenient length and dressed from 2-inch stuff to the required thickness, which varies from 1½ inches to 1¾ inches, according to pressure. The hoops are of ½-inch round iron and are spaced according to the size of the pipe and the pressure to which it is subjected, from 7 inches to 2½ inches apart. Inasmuch as the bursting pressure is

diem. The quantity of wood in feet, B. M., required per lineal foot is as follows: 24-inch pipe, 13 feet; 30-inch pipe, 20 feet; 36 inch pipe, 29 feet; and of iron from 20 to 40 pounds: 30-inch pipe therefore costs per foot about as follows:

or about one-quarter that of cast iron. Any kind of wood will answer for the staves which is fairly straight-grained and free from knots and shakes. In Denver California red wood is used, having been found superior, although more expensive than the native pine. The system is patented by Mr. Charles P. Allen, Chief Engineer of the Denver Water Company. We are indebted for the above facts and illustrations to Mr. W. Barclay Parsons, Jr., Mem. Am. Soc C. E.

EXPENSES OF THE WAR DEPARTMENT FOR PUBLIC WORKS.

THE total expenditure of the War Department during the last fiscal year on public works was \$9,863,552. Over \$100,000 has been spent on each of the following works during the year ending June 30, 1887-viz.: Building for State, War and Navy Departments, \$355,000; increasing the water-supply of Washington, D. C., \$348,000; purchase and reconstruction of Aqueduct Bridge, District of Columbia, \$121,000; improving harbors at Baltimore, Md., \$171,591; at Charleston, S. C., \$106,000; at Savannah, Ga., \$150,250; improving Gedney's Channel, New York, \$142,500; removing obstructions in East River and Hell Gate, New York, \$114,165; improving Delaware River, \$129,000; improving Potomac River, \$268,000; improving Great Kanawha River. \$112,500; improving Sabine Pass, \$165,000; improving Tennessee River, \$168,500; improving Kentucky River. \$121,000; improving Ohio River, \$224,762; improving Mississippi River. \$746,058; improving Mississippi River between Ohio and Illinois Rivers, \$194,018; improving Mississippi from St. Paul to Des Moines Rapids, \$148,500: constructing jetties and other works at South Pass, \$150,000: improving Missouri River, \$370,735; damages by improvement of Fox and Wisconsin Rivers, \$129,403 improving Columbia River at Cascades, \$112,497.

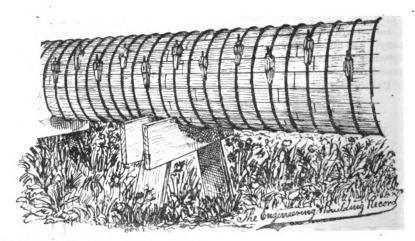
SANITARY IMPROVEMENTS IN BUENOS AYRES.

PROGRÉS de l'hygiène dans la Republique Argentine Par le Dr. E. R. Conè. 266 pp. Royal 8vo. Paris. 1887. The title of this book is somewhat misleading, since it relates mainly to the sanitary improvements which have been made in the city of Buenos Ayres, and include a very good description of that city from the point of view of the sanitary engineer.

a very good description of that city from the point of view of the sanitary engineer.

It contains twenty plates illustrating water-works, sewerage, schools, hospitals, etc. The descriptions are sufficient for general readers, the rules and regulations affecting municipal hygiene are given fully, and the whole gives

THE COLORADO WOODEN WATER PIPE



resisted entirely by the hoops, their spacing for any given head is readily calculated. The cast-iron clips, of which there is one to every hoop, weigh $2\frac{1}{2}$ pounds each. The pipe is used in Denver in four sizes, 24, 30, 36, and 48 inches diameter, and is subject to pressure varying from 50 to 120 feet of head. It has been laid to a radius of 175 feet. The cost of labor of laying, exclusive of excavation, is shout 20 cents per lineal foot for 24 and 30 inch pipe in Denver, where common labor is worth \$1.75 per

one a very good idea of what has been done recently to improve the hygiene of the city.

AN AUTOMATIC CUT-OFF.

C. HOLCROFT has patented in England a device to prevent overwinding in mine hoists. The hoisting rope passes between a pair of shear blades, which, if the cage is lifted too high, automatically cut the rope, while safety catches prevent the fall of the cage.

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THE PROPOSED NATIONAL BUREAU OF HARBORS AND WATERWAYS.

NEW YORK, February 20, 1888.

SIR: Senator Cullom's bill seems to have t SIR: Senator Cullom's bill seems to have two objects in view—viz., to do away with requiring an able and experienced civilian engineer to report to a younger and less experienced man, and to prevent, as far as possible, some of the abuses of the present system, such as appropriations for unprofitable improvements, and the much greater loss resulting from failure to provide funds for work in progress either through political dissensions or the vetoes of appropriation bills in obedience to demagogical clamors.

The first object seems reasonably well secured though

The first object seems reasonably well secured, though as no man need hold the position of civilian assistant on Government works who does not like it, it would not be worth while to trouble the legislators of our country for the first object alone, and furthermore, the bill still contemplates a close corporation of engineers in which promotion by seniority, a rigid regard for "record," precedent, and esprit du corps, combined with the authority of the older and more conservative members of the corps, will tend to prevent able and progressive engineering and still further settle on our practice the tendency, induced by our schools, to become repeaters of the practice of others.

I do not see that the Cullom bill would, any more than the present system, enable the country to avail itself of the genius of Eads, for instance, if he was still living, and think that one of the amendments referred to as possible in Mr. Corthell's letter should enable the country to secure the advice of able engineers whenever it may prove

As far as the bill under consideration goes in providing that the total estimated cost of an improvement should be appropriated at once, it cannot be too highly commended, as it will stop a fertile source of waste. The principal reason why Government work is more expensive than corporate or private work lies in the fact that nearly always appropriations are too small for an economical prosecu-tion of the work in hand; when to that is added the fail-ure of appropriations, sometimes leading to large expen-ditures for simple maintenance, as was the case at Flood Rock, or to a loss of a large part of the work done, as at Charleston harbor, for instance, the wasted money may amount to a large percentage of the cost.

In a discussion of Mr. Corthell's paper on "South Pass Jetties," read before the American Society of Civil Engi-

neers, the undersigned suggested that before any improvement was undertaken, a report on its necessity, on the plan to be adopted and its cost, should be made by a board composed of three civil engineers and three military engineers, associated with three or four persons interested in the commerce and industries of the lo cality to be served by the improvement, the appropriations to be made as provided in the Cullon bill.

provided in the Cullom bill.

Supposing that only the composition of the board may be seriously objected to, it is urged that the civil engineers or those not connected with the corps charged with river and harbor improvements, and hence not in danger from the displeasure of the older members, would not have their judgment hampered by a regard for the prejudices of these older members, or, in other words, new and independent views would be brought into each board, while the business men might and probably would be better judges of the necessary scope and extent of the proposed improvement and the resources which would be tributary to it than a board composed largely of strangers as the to it than a board composed largely of strangers to the

It is understood that Senator Plumb proposes the whole subject of public buildings out of the hands of Congress and placing it in charge of the Secretaries of the Treasury and Interior and the Postmaster-General." It is well known that various surveying and executive departments connected with engineering report to different sccretaries, and often do overlapping work. Would it not be well to create a new department presided over by a Secretary of Public Works charged with all surveys, construction, and maintenance of Government property except fortifications and ships?

EDWARD P. NORTH.

> U. S. ENGINEER'S OFFICE. QUINCY, ILL., February 17, 1888.

SIR: Referring to the Cullom bill for a National Bureau of Harbors and Waterways, I would say that I believe in an "indictment." It is necessary that all the facts and motives shall be expressed that the prisoner the facts and motives shall be expressed that the prisoner may know what is charged against him. So in a civil process a bill of particulars, or the petition itself, presents reasons and grievances, and asks for remedies, etc. Now it does not appear to be necessary that in legislative action any similar course should be followed. Were the analogy complete, the Corps of Engineers might ask wherein it had failed, and what grievances existed to make a change necessary? From the bill itself it would appear that an enlargement only was intended, resulting eventually in a separation from the Corps of Engineers of all duties connected with the improvement of the waterways of the country.

Country.

I cannot see any foundation for such action resting upon good ground. I believe I am reasonably well posted in the history of the Corps of Engineers and of its works, but I do not find therein any larger percentage of errors than are encountered in all lines of business. Therefore I fail to see any need for a change.

I do know, however, that beginning with the selection of candidates for the appointments to cadetships at West Point, and following through their subsequent education there, and after graduation, there is in existence in this country no fairer or more democratic and unpartisan sys-

tem of selection of men than is there found. I can readily believe that this system could be expanded to advantage, even by enlarging the educational course and varying it, so as to give attention to special subjects if necessary.

Very truly yours, etc., E. H. RUFFNER,

Very truly yours, etc., Capt. of Engineers.

United States Engineer Office, GALVESTON, TEX., February, 18, 1888.

Senator Cullom's bill to establish a National Bureau of Harbors and Waterways proposes to take from the Corps of Engineers of the Army the management of river and harbor improvements, and to place it in the hands of a new corps, which it creates, to be composed exclusively of civilian engineers. It also concerns exclusively of civilian engineers. It also concerns itself with some matters of detail which may be executed by the old organization as well as by the new one. Vast interests, involving the expenditure of from ten to twenty million dollars per annum, are suddenly transferred from an experienced corps to a new and inexperienced one. Under Section 22 every clerk and civilian engineer in service is turned out of it the day the bill becomes a law. So sudden and radical a change can be justified only by some great and pressing evil in the present system.

The present system may be described as including the

I. The inauguration of a work or the selection of waterway which is to be the subject of public expenditure, is retained by Congress in its own hands. Congress could delegate this power to the Executive if it chose, but it has not so chosen. The bill makes no change in this feature.

2. Plans and estimates of cost are prepared by a competent officer, and are then subjected to the scrutiny and criticism of superiors before being submitted to Congress, and must then have the approval of Congress before the work is begun. This feature is substantially adopted in

3. The money for carrying on the works for one year at a time is appropriated by Congress in annual appropria-tion bills. An improvement in this feature can be effected by the rules established by Congress for its own guidance, but not by legislation intended to govern the Executive but not by legislation intended to govern the executive. Section 14 of this bill seems to be aimed at some such improvement, but, if so, it fails entirely of its object. Its effect would be merely to put a sudden stop to every permanent work of river and harbor improvement in the United States. It would, in my judgment, be a very great improvement upon this feature of the present system if Congress would, upon the inauguration of any work, appropriate funds sufficient to complete it, the amount to become available for expenditure during each year being fixed in advance. In nearly all cases where the results of river and harbor works have been unsatisfactory the evil may be traced to the system of annual partial appropriations. This bill offers no remedy, and no bill, except an appropriation bill, can offer one.

4. Finally, the works are executed by the Corps of 4. Finally, the works are executed by the Corps of Engineers, a military organization, recruited exclusively from the most distinguished graduates of the U. S. Military Academy. This corps not being large enough to provide for all parts of all the works, its officers are compelled to employ a considerable number of civilian engineers as assistants. It is only in exceptional cases that civilians are placed in independent charge of works, or are concerned with the disbursement of money. They usually remain in subordinate positions, and they are not assured of permanent employment. Their number is increased or diminished according to the necessities of the service. Their number is increased or With appropriations varying in amount from year to year so largely as they have done, the number has fluctuated so largely as they have done, the number has fluctuated considerably. Worthy men have been thrown out of employment, without fault of their own, when there was plenty of work for them to do (but no money to pay them with), and other worthy men have had their promotion stopped at the grade of principal assistant with salaries usually not exceeding \$2,400 per annum, and with no prospect of further advancement. These are two evils which should, if possible, be corrected. They are evils, however, which affect the personal interests of a very sall number of men, and in correcting them care must be taken not to inflict injury upon great public interests. be taken not to inflict injury upon great public interests.
It is to be remembered that there is no breach of contract. These gentlemen have accepted their positions with the conditions now attached to them, and could abandon them at any time if more favorable positions were open to them elsewhere.

It must be assumed that, as a rule, the officers of the

It must be assumed that, as a rule, the officers of the Corps of Engineers are fully competent as engineers to plan and conduct these works, and that they are faithful to their trusts. The truth of these assumptions has not been questioned by disinterested persons. Certainly Congress will not assume the contrary without careful investigation. I will not now discuss the matter.

On the 1st of January, 1888, the number of officers connected with river and harbor improvements was 67, and their total annual pay including allowance for quar-

connected with river and harbor improvements was 67, and their total annual pay, including allowance for quarters, was \$246,354. Of these 27 were engaged also upon other duties, their salaries amounting to \$126,352. The last full statement of civilian assistants employed upon these improvements is for October 31, 1886 (see Ex. Doc., No. 126, 49th Congress, 2d Session). At that time there were 104 assistants in service, upon a total annual pay of \$207,300, and this may be considered as approximately the average number employed in years when appropriations have been made. The number of officials, civil and military, is therefore about 171, and their total annual pay is about \$453,654, or if the

salaries of officers engaged also upon other duties be omitted, the total annual pay is about \$327,302. This constitutes a flexible body of officials, which can be entired and distributed according to the appropriate of months. larged or diminished according to the amount of work that it may have to do. With the uncertainty and irregularged or diminished according to the amount of work that it may have to do. With the uncertainty and irregularity which now characterize the annual appropriations, it is perhaps as efficient and economical an arrangement as could possibly be devised. The new bill proposes to replace it with a body of 615 officials, whose total annual pay is to be \$1,180,000. This increase is greatly in excess of the needs of the service at present or in the near future.

The present Corps of Fregingers was critically assets.

The present Corps of Engineers was originally created partially for the purpose of conducting works of internal improvement. It has always had charge of the river and harbor works, upon which it has expended some \$125,000,000 or more. Works of this kind are as much its specialty as are fortification or military mining or map-making. Necessarily its officers are more experienced in this branch of engineering than other engineers. Their civilian assistants have gained experience also, and some of these are thoroughly fitted in character, talents, and experience to take independent charge of works. But the great majority of them are of course better fitted for the subordinate positions which they occupy. The number of civilian engineers in the country who are now competent equally with the officers to manage these work and the number of these who would be available for appointment in the new organization is still smaller. Yet the bill provides that out of the 615 positions created only fifty-three, or one-half of each of the four highest grades, and one-fifth of the next grade, may be filled from the present corps, either by appointment or by temporary detail for not more than two years. The remaining 562 officials are to be taken from civil life. And at the end of two years every officer must sever his connection with the works or give up his commission in the army. This is to throw the management of the works very largely into the hands of persons who, at least for the present, are unskilled and inexperienced.

Passing to a consideration of the bill by sections many defects of detail are found.

In Section 3 provision is made for a larger number of officials in the lower grades than are necessary, but with very imperfect arrangements for their supervision. An very imperient arrangements for their supervision. An advisory board drawn only from one grade, in which are but four officials in all, would not be a good one. The board should be selected by the chief without regard to rank, and should be composed of five or seven members. There is no provision for inspection of works or proper supervision of money accounts. supervision of money accounts.

By Sections 4 and 6 new appointees are placed over the heads of the men who have had charge of these works. A reflection is thus cast upon these latter which is unjust Section 7 is somewhat obscure, but seems to contemplate

Section 7 is somewhat obscure, but seems to contemplate giving to army engineers the option of accepting or declining temporary appointments in the new corps. The President should have the power to order them to perform these duties. It may be doubted whether many of them would accept the duties voluntarily upon the terms prescribed in the bill scribed in the bill.

Section 8 is obscure. If it means that no more appointments below the grade of Department Engineer are to be made than are needed, the language should be altered. Authority should be given to some person or persons to determine what the necessary number is.

In Section 9 the rates of pay are very much higher than those now paid for the same services.

In Section 10 retirement upon half pay at the age of sixty-five is provided for without reference to leave the

sixty-five is provided for, without reference to length of service, which is in violation of the principle upon which such allowance should be made.

such allowance should be made.

In Section 13 the requirements that there must be from 9 to 11 departments, and that every department must be under a department engineer, would put some of them into unfit hands. The number of the departments and the assignments to their command should be left to the Executive as in the army. tive, as in the army.

Section 14, so far as it changes present law, has already been alluded to. It simply stops all permanent works.

Sections 15 and 16 are mere statements of routine, fol-

lowing military precedent, and may better be left to the "Rules and Regulations," for which separate provision has already been made in the bill.

has already been made in the bill.

In Section 17 there is much statement of routine which would better be left to the "Rules and Regulations." The object of the section would be accomplished by simply requiring the Secretary of War to report annually upon the subject referred to. It may be doubted, however, whether such a report is needed annually. It may be made from time to time as Congress may call for it, or as the Secretary of War may think desirable.

Section 22 has already been alluded to. It dislocates in a violent manner the present administrative machinery for

a violent manner the present administrative machinery for

carrying on the works, and cannot fail to do great harm.

There are numerous other defects, but sufficient bave been mentioned to show that the bill as a whole is not in the interest of efficiency and economy, and should not receive the indorsement of any patriotic citizen.

receive the indorsement of any patriotic citizen.

The imperfections in the present system have already been pointed out. It is greatly to be hoped that Congress will soon adopt the policy of providing, at the beginning of any work, the funds necessary for its completion. Such a policy would carry with it greater care in the inauguration of new works; and it would make the position of the civilian engineer a less precarious one. Whether an improvement in the organization could then be made may be open to discussion. I am inclined to think not. In be open to discussion. I am inclined to think not. avoiding the minor imperfections which exist in the present

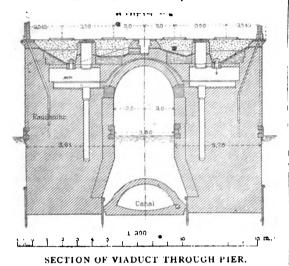
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organization it will be easy to fall into much greater ones. The difficulties of properly recruiting a corps of this kind from any but a special Government school seems almost insuperable. At all events, no change in the organization is at present present upon desirable. is at present necessary or desirable.

Very respectfully, your obedient servant,
O. H. Ernst, Major of Engineers.

THE BERLIN METROPOLITAN RAILWAY.

THE translated description of this work was concluded in our issue of February 11, but in this and a succeeding issue we shall give a number of illustrations of typical stations, bridges, etc., on different parts of the line. The



section of street crossing given below is of interest, as showing the arrangement of road-bed, support of rails and methods of drainage. The structure of which it is a section is not shown. Other arrangements of rail support, ballast and drainage are shown on the section of bridge over the Humboldt Basin, showing pier, and also on the section of viaduct through pier, which is a section of the viaduct through blocks shown on the opposite page, where the bridge over the Humboldt Basin is also to be found.

The "Canal" shown on section of viaduct through pier is an overflow or storm-sewer.

The wrought-iron pendulum column has a ball-bearing top and bottom, and is used under the continuous girders of the Koeingstrasse crossing, which will be shown in a succeeding issue. It will, of course, be readily perceived that the bridge over the Spree at Bellevue Park is on a skew, and that the other bridge over the Spree, shown above, it is not really continuous with the viaduct through blocks, but has been so drawn merely for convenience and contrast.

(To be continued.)

PAVING AND PARKS FOR BROOKLYN.

MAYOR CHAPIN, of Brooklyn, favors the issue of \$1,700,000 of bonds to provide for street improvements, such as paving, constructing sewers, erecting buildings for educational purposes, or securing eligible sites for such buildings, and \$300,000 of bonds to provide small parks in regions remote from any existing park. Of such small parks Brooklyn has a great and increasing need, and its rapid growth is rapidly increasing both their necessity and the expense of providing them.

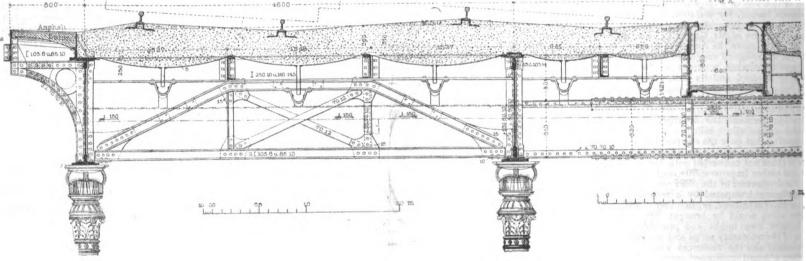
THE NORTH RIVER BRIDGE.

MAYOR HEWITT, of New York City, has been officially requested by the New Jersey Commissioners of the New York and New Jersey Bridge Co. to take such action as may be necessary to secure the appointment of similar commissioners by the Legislature of New York to co-operate with them. It is proposed to locate the bridge near Spuyten Duyvil Creek.

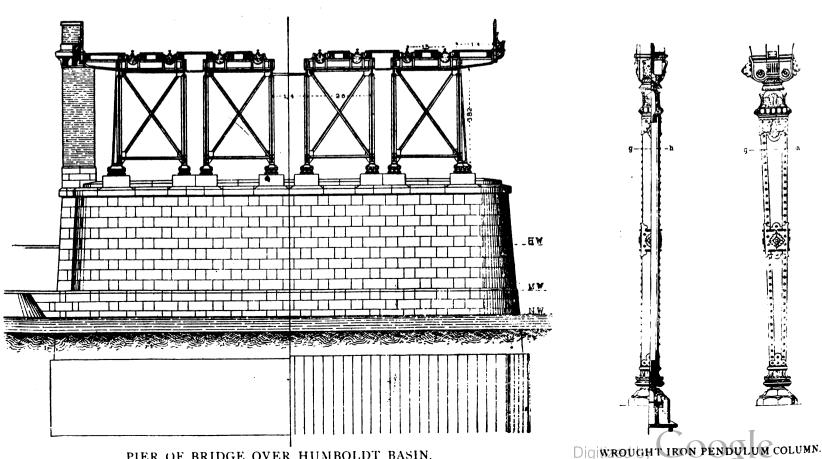
NEW YORK RAPID TRANSIT PLANS.

THE Board of Aldermen have requested the Legislature to pass an act, by which the Commissioner of Public Works is to be directed to prepare, under the Mayor's direction, for the more rapid transportation of passengers, mails, and freight within the limits of the city by underground railway or otherwise. The city is vested with power to have property needed for the purposes of the proposed road condemned, and is authorized to contract with any railway company having a terminus in this city for the construction, maintenance, and operation of the proposed railroad. No more than five cents shall be charged each passenger using the proposed road. Any motive power other than animal power may be used.

SUIT has been brought in New York City to put an end to the maintenance of a Babies' Hospital in a residential quarter, on the ground that it is a nuisance and dangerous to the health of the neighborhood.



SECTION OF STREET CROSSING.



PIER OF BRIDGE OVER HUMBOLDT BASIN.



PLUMBING IN THE RESIDENCE OF MAX NATHAN, ESQ. No. III.

(Continued from page 184.)

FIGURE 10 illustrates a device for suspending pipes from the ceiling. A ceiling strip of wood is secured to ceiling as shown, and hangers fastened to it. These hangers are made of wrought iron, three-fourths of an inch in width, and one fourth of an inch in thickness, and convex on lower side. The sketch shows the pipes suspended about twelve inches below ceiling, but the length is controlled by position of pipes desired.

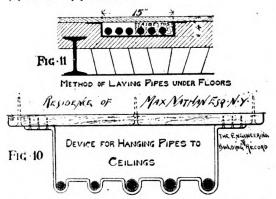


Figure 11 illustrates the manner of laying pipes under floors, and is utilized wherever pipes are laid under floors in the hall and dressing-room. A recess under floor is lined with sheet-lead in the form as shown in section, and is connected with waste-pipes that extend to cellar, and therefore if any leak in the pipe should occur the water will be removed without injury to ceiling below. The cold-water pipes are covered with asbestos mortar to prevent adjacent hot-water pipes from heating the cold water.

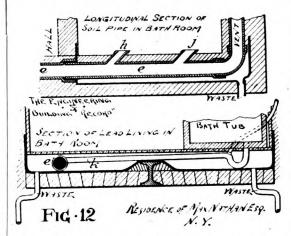
All vertical pipes in the partitions are inclosed in tubes of a la ger diameter, and the lower end of these tubes are also connected with safe-wastes extending to cellar.

In Fig. 12 is shown sections of soil and waste pipes in the bath-rooms. The entire floor of bath-room is lined with sheet-lead, which extends up the walls back of wain-scot. This lead lining is indicated by heavy black lines. Fire-proof blocks are utilized for filling above the lead lining up to the tiled floor. At the point where the soil-

pipe passes out of the room the lead lining is inlaid into the hub as shown. Safe-waste pipes connected with this lining are carried down to cellar. The lead lining is laid about seven inches below surface of floor, which gives a space of four inches over the iron girder. This depth of seven inches will allow the necessary space for the traps required under the bath-tubs.

The illustration in Fig. 13 represents a horizontal boiler suspended from ceiling, and in Fig. 14 is shown the detail of hangers, which will first be described.

A tube of galvanized iron is let into wooden beams and T-collars slipped over it, and into these T-collars sections of pipe are screwed in lengths to give the requisite height of boiler. At / is shown a detail of connection with boiler. Copper bands about four inches in width pass around the boiler with the ends projecting above, and in between these a copper plate is inserted, secured to them by means of bolts. The opposite end is circular, and is screwed to the tubes described above.



This boiler will contain 160 gallons, and is divided into two sections by a vertical plate in the centre. A' shows the low-pressure boiler, and B' the high-pressure. This form of boiler was used on account of the narrow space between the range and outer wall of building.

In Fig. 13 this system of pipes is shown which will now be described. The cold water for low-pressure supply passes from cellar up A entering boiler at top and passes out down A to B, thence up into heater and out through pipe C returning to boiler. From boiler the hot water flows through D to elevator-shaft in the laundry, which is located here in the extension. The branch D' runs to fixtures in rooms above. M is a circulation pipe on low pressure, and N circulation for high pressure. The pipe B extends down to cellar, thence to laundry-range. The pipe E branches from B below heater, thence up to ceiling, and also to laundry-range; but the direction of the

flow will be down the pipe B to range, and returning through E.

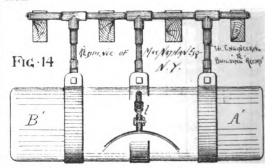
The high-pressure supply passes down G to boiler B, thence to pipe H, and thence to range through I, returning through J and H to heater, and through K to boiler. The hot water flows out through L to elevator-shaft and up to bath-rooms. The branches G' L' N' carry supply to fixtures in rooms above basement. F is an intermediate supply between high and low pressure, having a stop-cock which cuts off the flow. This pipe is continued from D over boiler down to sink to supply hot water. The cold supply for sink branches from A. The pipe H terminates at the floor. The cut-off shown in Fig. 5 is on second floor, located as described for No. 22.

This heater is intended for use in dwelling houses where two systems of water-supply are utilized.

The ordinary methods employed for this purpose are either connections with two water-backs set in a range, or with a boiler made in two sections, the hot-water circulation in the outer section heating the cold water in the inner. When two boilers are used, one for high and one for low pressure, this heater is set between them.

This device is circular in form, 8½ inches in diameter and 13 inches in height, and is made of heavy copper, the outer shell being made separate, permitting the inner chambers to be detached.

The form of the chambers is shown in plan, the circle at H representing the position of the tubes connecting the chambers. The small circles at E F are braces to increase the strength of the chambers, and are required on account of the unequal water-pressure. A brace is also set in the centre of each chamber, the position being indicated by dotted line at G. The heights of each chamber and spaces between them are each three-quarters of an inch.



METHOD OF HANGING HORIZONTAL BOILER TO CEILING .

The high-pressure supply, after being heated in the range, enters at A, thence passing up through each chamber, as shown by broken lines in section, leaving the heater at B to supply the upper stories.

The cold water from low pressure enters at C, flowing from lower to higher chambers through openings shown in plan and section at E E, occupying the entire space shown in white, and exposed to a heating surface of more than 1,000 square inches before passing out at D.

This device, invented by Mr. John Tucker, of the firm of Byrne & Tucker, plumbers, New York, who executed the work here described, is an improvement on a former one for a similar purpose.

The architects were William Shickel & Co., of New York.

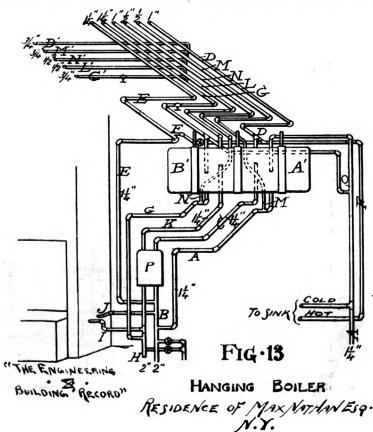
THE RESULTS OF LEAD POISONING.

In some obscure cases of lead poisoning at Sheffield, England, which have been referred to in a recent issue of the *Local Government Chronicle*, the result is stated to have been the production of indigestion and pain in the limbs in mild cases, and in more severe cases paralysis of the wrist and hand, and granular disease of the kidneys. The water dissolves not only the lead in the pipes, but also in some instances the lead to be found in kettles.

In England the working hours of a plumber during the twelve weeks following November 9 have just been agreed upon between the Central Association of Master Builders and the United Operative Plumbers' Association as follows: 7 to 8, 8:30 to 12, 1 to 4:30; on Saturdays, 7 to 8 and 8:30 to 12, giving a weekly total of 44½ hours. The hours will apply to both society and non-society men.

WE are surprised to learn from the Omaha Bee that that city is without hospital accommodations. A movement is on foot to secure land on which to erect a city hospital. Certainly an enterprising city like Omaha should not be without suitable hospital buildings.

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ON MAKING LEAD BENDS IN PLUMBERS' SHOPS.

BOSTON, February 6, 1888.

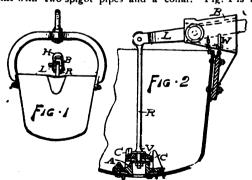
SIR: I have been much interested in your Milwaukee correspondent's description of how to keep the plumbers out of mischief during the winter days by employing them in making lead bends, page 90 of your issue of January 7; also L. H. D.'s criticisms thereon, page 137 of January 28. All such shop-made bends would be sure to find their proper place in the scrap and old lead bin and would never be used on a job. Mr. Nicholson's method is antediluvian, and no doubt was invented by some genius a few short years after Noah's flood and at a time when the plumbers worked eighteen hours a day and the bosses charged twenty-four. Yet with all this L. H. D. should not criticise a system that his own antedates, since his method would necessitate the keeping up of a moderatesized lumber yard as a sort of annex, with steam saw and planer attachment for the manufacture of plugs. All this means that the boss would have to furnish each man with a mule team or pony express to cart round his kit. This pony express would look well going up Broadway, reminding one of the mounted brigades of sightseers leaving a Manitou hotel for Pike's Peak, only a little more ludicrous. This would be a fine subject for the funny man of the press, which he could fatten on.

As I stated above, shop-made bends might amuse the plumber, but it would be money in Mr. Nicholson's pocket to furnish each of his men with an easy chair and let them pass their time away smoking their T. D. pipes, and not use his men in destroying lead pipe. If L. H. D. had not mentioned the tapering of his plugs and adding the holes in the ends, his criticisms might be passed over. If he knows anything about pipe-bending he should know that a tapered plug used at the end, to be taken hold of during bending, if the bend is to be made near the end would not only cause a bulging of the pipe at the back, but a kink at the front, caused by that part of the plug which is in the pipe being tapered, which it should not

A plumber can whittle out a plug with his pocket knife in two minutes which would fit the pipe tightly without any taper. A piece of wood he can always find on the job and dispense with the pony express. J. T.

LEAD LADLE FOR PIPE-JOINTING WORK.

THE accompanying engravings illustrate a lead ladle made from a patent of Mr. H. Nicholson, and described in the Engineer, to facilitate the running of the molten lead into the joints of water and other cast-iron pipes. The objects are to prevent the admission into the joint of scum or dross, to dispense with any necessity for skimming the lead, to enable the lead to be run without tilting the ladle, and to minimize the danger to the operatives. It has, further, for its object to enable the lead to be run simultaneously on both sides of the collar when making a joint with two spigot pipes and a collar. Fig. 1 is a



front view; Fig. 2 is an enlarged section of the valve rod and lever. These improvements consist in attaching to the bottom of the ladle a raised valve seating A, within which is a conical or cylindrical hole for the exit of the metal. The plug or valve is constructed partly of fire-clay, and is attached by means of a rod R to a lever L, the fulcrum of which is mounted upon a bracket B secured to the rim of the ladle. This bracket has stops for limiting the amount of angular motion of the lever L, so as to prevent the valve or plug being lifted beyond the range of the guides C. To prevent the accidental escape of the molten lead by an accidental move-ment of the lever, between the lever L and the bracket B a key or wedge W is inserted, which is removed when the joint has to be run.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for addional information before printing their communications. Anonyous letters will not be noticed.

WHAT IS THE BEST WATER-PRESSURE REGULATOR?

54 BEEKMAN STREET, NEW YORK, February 17, 1888. SIR: Kindly inform me which is the best water-pressure regulator and where it can be got, and oblige
Yours respectfully, Louis Waefelaer.

[Referred to our readers.]

NOISE CAUSED IN THE MAINS OF A STEAM-HEATING APPARATUS BY AN IMPROP-ERLY-ARRANGED RELIEF-PIPE.

GRAND FORKS, DAK., January 17, 1888.

SIR: We have lately warmed a separate building two hundred feet distant from our main building. The pipes in the new building are exceedingly noisy at times, snapping and pounding, and all our efforts to prevent it have thus far been only partially successful. We therefore apply for advice through your journal, sending sketch made by our janitor, and hope you will be able to suggest a remedy.

HOW TO PROPORTION RADIATING SURFACE.

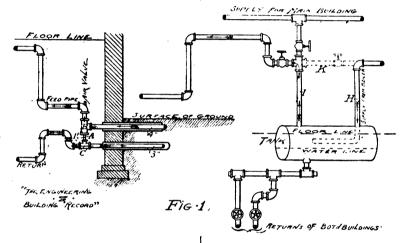
BUCYRUS, O., February 18, 1888.

SIR: Will you, either by personal letter or through the columns of your journal, give me a comprehensive rule for determining the proportion of radiating surface to cubic contents in rooms to be heated by steam, together with allowance usually made for exposed situa-tions, etc? We are building new offices, and would be glad to have some information of this kind with which to work. Yours very truly, W. R. CRITTENDEN.

There can be no very accurate rule for determining the heating surface by the cubic contents of rooms or buildings. The method followed by many of allowing 1 square foot of radiating surface to 25 cubic feet of airspace as a maximum, to I square foot to 200 cubic feet as a minimum, is of no service except in the hands of a man of considerable practical experience, and then serious blunders are made with it.

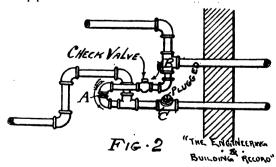
A room of 1,000 cubic feet in a tower with windows on all sides, would probably require "1 to 25," and in windy weather that might not do.

The same room on a corner of a building, with windows and outside walls on two sides, would probably require I to 40; a middle room of same size, with windows on one side, I to 55, or thereabouts. Now, if the latter room is made twice as large, by increasing its front measurement only, it will require just the same pro-



A shows connecting-pipe, 1 1/4 inches in diameter, between the live-steam pipe B and the return-pipe C. This connecting-pipe, which is only two or three inches long, is open, and allows the live steam to meet the returning water. At least I so understand it, but I am not engineer enough to know the philosophy of it. H. B. S.

[From the data sent, we are able to give you very little advice in the matter of the noisy pipes. In other words, we are unable to determine whether the trouble is a defect of principle or of detail. We are of the opinion, however, that should you alter the connection A in such a manner that you can put a check-valve in it the noise may stop. If the tee B is too close to the tee C to put in a connection with a check-valve, connect B to some other part of the return-pipe, say as shown by the extra lines in Fig. Use a swinging check-valve the full size of the pipe (11/4-inch), and have it open from the main into the return-pipe.



We are unable to see the good accomplished by the pipe H-the main steam-supply from boilers-entering the receiving-tank as shown, and the steam thence passing from the tank through the pipe I to the coils, etc. We rather consider it a disadvantage by causing unnecessary friction and condensation. If after trying the check-valve in the relief main the water still rises or remains in the main at B, connect the pipe H to I by the direct pipe K (dotted lines), and either remove the pipes H and I or put valves in them so they may be closed. If you do the latter, put a valve also in K as shown.]

portion (1 to 55) as above, because the cooling surfaces increase in the same ratio as the cubic contents, whereas, if this room was made twice as large by increasing its depth only it would require very little more surface than it did when it had only 1,000 cubic feet.

Now take a room of 10'x10'x10', or 1,000 cubic feet, on a corner, with windows and outside walls on two sides, and it is evident it will require as much surface as a room 20 feet on the front by 10 feet deep and 10 feet high.

The radiating surface in a room must vary in the proportion of the outside walls and windows, and not in the ratio of its cubic contents.

There is no accurate rule that we know of, but the most comprehensive on the wall and window surface is found on pages 26 and 27 of "Steam-Heating for Buildings," the summary of which is to allow three-quarters of a square foot of surface to each square foot of glass or window opening, and the same for each 7 to 10 square feet of outside wall surface. This is for low-pressure steam, with good efficient radiators or coils. With some radiators that are sold, however, three-quarters of a square foot would not be sufficient.]

CAUSE OF DAMPNESS ON HOUSE-WALLS.

NEWARK, N. J., October 24, 1887.

NEWARK, N. J., October 24, 1887.

SIR: Will you please inform me what causes dampness on inside hall walls? It shows through the paper all the way up to the top of second story hall. There is no water in the house, and the washing and cooking is all done in an extension. The roof is good, and there is a good cellar under the house. The hall runs straight through the centre of the house. The dampness shows on parlor and library side of hall partition, and it was never noticed until this year. The cellar side walls are a little damp sometimes.

OLD SUBSCRIBER.

[If the facts are exactly as stated we can suggest no explanation, but we strongly suspect that a more careful examination will show the roof to be at fault, most likely where it joins with some chimney, if any flues go up in the partition. If this snound has further particulars may give some clue. the partition. If this should not be the case, perhaps

FILTERING STEAM.

MILWAUKEE, February 7, 1888.

SIR: I would like to ask if you can give some advice or recommend some way of filtering steam. The instance is this, black specks, resembling soot, accumulate, and I know they originate in the boiler. I have been experimenting with felt and caught the diminutive black specks through a fine wire screen, and now am positive they come from the boiler. If you can give me any information regarding the filtering of steam, so as not to decrease the pressure very materially, I shall be very thankful.

A SUBSCRIBER.

[We have had no experience with the filtration of steam, and refer this question to our readers. Presumably our correspondent desires to use steam in some process of manufacture where specks of foreign matter carried with the steam are objectionable. If it were our case we would collect sufficient of the specks to examine or analyze them, and determine whether they are particles of iron, or rust, or oil, or earthy matter. Then, after ascertaining what they are, some means of collecting them can probably be determined. It is very probable, no matter what they are, that they may be deposited if the steam is carried through a chamber large enough to so lessen its velocity that the objectionable particles may have an opportunity to settle to the bottom. A few baffle-plates might be used within it to advantage, but they should be so arranged that the steam would strike their surfaces with a very slow velocity; otherwise there will be no deposit. If the steam as it enters the chamber is directed against water lying in the bottom, the water will also help to collect the foreign substances, provided the steam has not velocity enough to disturb the water and keep it in agitation. Oil is separated from steam in this manner (see page 171 of "Steam-Heating Problems"). A layer of asbestos fibre between a pair of wire screens might also arrest the particles. Its area, however, as compared to the pipe is a matter of speculation, and, presumably, it should not be less than 100 times greater than the pipe. This would become saturated in time and have to be renewed.]

CAN A HIGH-PRESSURE STEAM APPARATUS BE RUN MORE ECONOMICALLY THAN A LOW-PRESSURE ONE.

SIR: We are asked the question whether a high pressure steam-heating apparatus cannot be run more economically than a low-pressure one, for heating pretty large buildings, and are told that engineers and firemen say they can carry sixty pounds of steam with less fuel than forty pounds. Is this true or false? We should like any information you can give on these points.

[The lower the pressure of steam carried on an apparatus the cheaper it can be run, all other things remaining the same.

The average condensation of steam per square foot of surface at one pound pressure is about $\frac{1}{4}$ pound weight per hour; at 40 pounds pressure it is about $\frac{1}{3}$ pound per hour, and at 60 pounds $\frac{1}{10}$ pound.

A high-pressure apparatus may be constructed by using smaller pipes and less heating surface that can be run as cheaply as a low pressure, and do the same work, but it cannot be run cheaper.

It sometimes happens that an engineer has a set of boilers in his care that supplies steam for engines and heating apparatus as well. By carrying a high pressure he may then find he uses less fuel, in which case the saving done by using high pressure in the engine more than compensates for the extra loss in the heating apparatus.

If he uses steam through a reducing valve for heating and carries no more pressure on the house than before, then there is no increase of condensation in the pipes, and the saving in the engine is more apparent in the coal-heap, and is apt to be credited to the wrong cause.]

WHERE CAN ASPHALT BE OBTAINED FOR PAVING?

____, February 17, 1888.

SIR: Please let me know if any concern has the monopoly of imported asphalt such as is used for paving streets; if not, whom can asphalt be bought of? Any information you can furnish me on this subject will be appreciated. I made a suggestion that this city organize an asphalt paving department, but was told that it could not be done, for the reason that the Barber Company and the Warren-Scharf Company control the importation of Trinidad asphalt.

Referred to our readers, with the suggestion that our correspondent inspect our advertising columns. We believe he is correctly informed in regard to the control of the importation of Trinidad asphalt by the parties named, but there are other paving asphalts.—ED.]

Novelties.

Juder this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

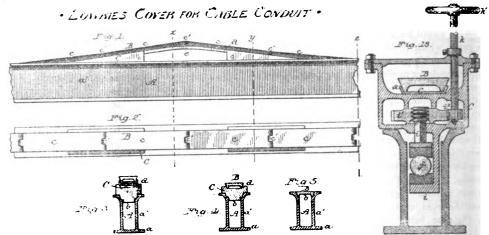
COVER FOR SLOT OF CABLE CONDUIT.

A RECENT invention of interest is a device for keeping the slot of a cable conduit constantly closed, devised by Mr. H. C. Lowrie, City Engineer of Denver, Col. It consists essentially of a series of plates, c, hinged together and forming collectively a continuous and flexible covering, B. Figures 3, 4, and 5 show sections on lines x, y, and z, respectively, in Fig. 1. A is any convenient form of conduit, with suitable cover seats at the top; C is the cover-lifter, tapering at each end, and having a groove in its upper surface to support and guide successive sections of B; e is an opening transversely through C to admit the grip.

GAS BY THE WEEK.

A CURIOUS proposal is being debated in various quarters in England, that gas companies in large towns should encourage the use of gas in working-class dwellings by taking weekly payments for the gas-supply. It is said that this would tend to supersede the use of petroleum. The Engineer thinks that if the consumption of volatile burning oil among the humbler classes could be diminished by the more general use of gas, a considerable sacrifice of life would be prevented. Fatal accidents with lamps are painfully prevalent, and great fires have sometimes arisen in a similar way.

THE "proverbial uncertainty of the electric-light"—as the gas journals say—is aptly illustrated by the following little incident, which the London Electrician believes to be authentic. A lamp had been hung from the kitchen ceiling by insulated wires; so when the housemaid wanted a light in the cellar she did not hesitate to cut off thelamp and hang it from the bell-wire. Then she said she "didn't never believe in these here new-fangled notions."



C travels with the grip and continually raises the cover sections in front and guides them back to their seat behind. The sides of C are closed, except at ϵ , and this opening is filled by the grip-bar, thus never leaving an opening to admit snow, dirt, etc.

Figure 18 is a detail showing cross-section of conduit and a suitable arrangement of grip.

The covering and lifting devices are applicable to electric and other conduits, and may be widely modified in many respects, as indicated in patent.

Gas and Electricity.

Illuminating	Powe	r of	Gas is	n Nev	v Yor	k City	·
Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
February 18	21.97	19.81	19.83	29.95	27 61	22.66	30.8g

A NOVEL PATENT.

WHATEVER some people may think of the value of many claims in American patents, we know of nothing quite so absurd as a case recently noticed in Great Britain. According to the London *Electrician*, three years ago last May Her Majesty's Letters Patent were granted for an "invention" of a surprisingly novel and ingenious character. The specification contains only one claim, which reads as follows: "Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is combining with an article of furniture a primary or secondary battery substantially as described."

The inventor now informs the *Electrician* that he has reason to believe that certain person or persons (unnamed, probably "too numerous to mention,") have defrauded him of his just rights by making and selling articles of furniture combined with primary or secondary batteries substantially as described, without having obtained from him, the aforesaid first and true inventor thereof, a license so to do. The hope is expressed that this public notice will be sufficient to check such palpable reprehensible malpractice.

SEWAGE TREATMENT, PURIFICATION, AND UTILIZATION. By J. W. Slater, F. E. S. 271 pp. 8vo. London: Whittaker & Co. 1888.

This little book is announced as being "a practical manual for the use of corporations, local boards, medical officers of health, inspectors of nuisances, chemists, manufacturers, riparian owners, engineers and ratepayers." It is in reality intended to maintain the superiority of a particular mode of the chemical treatment of sewage, which is, however, not definitely described, and which is probably a patented method.

The objections to all other modes of dealing with sewage are very well presented, though the author is a "man with a grievance," which grievance is the folly of all Government officials who have to deal with sewage, and which crops up in a more or less amusing way throughout the book. 'Bazalgettism' is a word which evidently delights him much.

He remarks that "there is no subject outside the range of party politics on which so much envy, hatred, malice, and all uncharitableness prevail as on the treatment of sewage." Matters must be worse in England than in this country, if we may judge from this statement taken in connection with the hints given to officials in charge of sewage-works as to the precautions they are to take in allowing any one to have a sample of the effluent for analysis or for preservation. In the first place, he says that the sewage-works must be so arranged that it shall be impossible to take a sample surreptitiously, and that the manager shall always be able to state upon oath whether a given person did on a specified day receive a sample or not. In the second place, no visitors are to be admitted, and no sampling allowed at times of flood.

The act of taking samples is to be done in the presence of both parties, and a sample is to be given to a visitor solely on the condition that he takes and seals at the same time a check sample to be left at the works for analysis. We have not yet got to the point indicated in this advice, which we have no doubt is very sensible for the locality for which it was written. While Mr. Slater's book is more valuable as a summary of objections to most methods of sewage disposal than as giving positive directions as to how sewage should be disposed of, it is nevertheless a well-written work, with a slightly acid, but not unpleasant, flavor, and a book which we commend to engineers as being both amusing and instructive.

TWO REPORTS ON RESEARCHES CONCERNING THE DESIGN AND CONSTRUCTION OF HIGH MASONRY DAMS.

BY B. F. CHURCH AND A. FTELEY.

THESE valuable reports are published by the Aqueduct Commissioners of New York, to whom they were made. They are not intended as full treatises upon the subject, but were written for the information of the Commissioners to aid them in the consideration of the plans for the Quaker Bridge dam.

The first, written by Mr. Church, the Chief Engineer, discusses the question of dams curved horizontally as compared with straight dams. He arrives at the conclusion that curved dams, except where very short, are not advisable.

His first proposition is that when a curved dam has sufficient area of cross-section to resist the water-pressure by its own weight it cannot act as an arch. The inertia of the cross-section will prevent the necessary horizontal movement, whereby alone thrust can be transmitted to the hillside abutments.

He next supposes the curved dam to be reduced to from 80 to 100 feet in thickness, and sufficiently elastic to act as a horizontal arch against the water-pressure. He finds that with a radius of 900 feet the pressure on the radial joints would, even if uniformly distributed, be from 42 to 39 tons per square foot, which is entirely too much for safety, and the flattening of the horizontal arch that would be caused thereby would create dangerous tensile strains on the concave side.

He then considers the effect of increasing the cross-section, the radius remaining the same, until the pressure is reduced to sixteen tons per square foot on radial joints. The result is a dam with twice the section required by a gravity dam having the same limit of pressure.

He concludes that "there is no valid reason for risking the complicating and serious rupturing strains which a curved dam will produce, or for the increased expense it would entail." We commend this conclusion to those who are constantly advocating the arched form as the only proper one to adopt for this important structure.

One strong reason for rejecting the curved form he finds in the fact that the vertical joints have no load upon them while building, and for lack of that initial compression are not in nearly as good shape to resist the strains due to the arch action as the horizontal joints are to resist the strains in a straight dam.

Mr. Church next discusses the form of section required for the dam, assuming the masonry to weigh 1561/4 pounds per cubic foot, that the pressure at toe is limited to sixteen tons per square foot, and that the resultant of pressure passes within the middle third of the base. The theoretical form thus obtained would be triangular to a depth of 205 feet from water surface, and slightly curved outward on both faces below that to keep within the limiting pressure. This form is then modified to resist ice thrust and wave and wind action, and for certain constructive reasons and finally a practical section is obtained.

Mr. Fteley, Consulting Engineer, presents plans and sections of the most important high masonry dams now in existence, with a resume of the literature on the subject. He points out the excess of material used in the older dams, and shows that the more modern sections are very similar to the one adopted for the Quaker Bridge structure. The pressures in some of these old dams are comparatively high, in at least one instance reaching 14 tons per square foot, and their long and successful operation proves that the low limit of pressures recommended by some modern authorities can be safely exceeded.

He then proceeds to show how the actual profile of the dam was designed, representing these well-known conditions as follows:

First.—The resultant of the forces acting on the dam, whether the reservoir is full or empty, must pass through the middle third of the base.

Second.—The pressures on the masonry at either face, and at any point, must not exceed a certain safe point.

Third.—The sections of the dam at any point must be such that no sliding can take place.

The limiting pressure finally adopted was fifteen tons. Careful studies were made of various proposed sections. A method based upon the principle of moments, although preceded by successive approximations, was found to be most simple and expeditious. It was checked finally by graphic and analytical methods.

Mr. Edward Wegemann, Jr., special assistant and divis-

ion engineer, devised a simple and exact analytical method for determining directly the profile of a masonry dam. It is based primarily on the fundamental formulæ for the distribution of pressure, and on the first two of the three conditions already given.

After a full discussion of the question of transmission of strains through masonry (as modified by the elasticity of the material); of the kind of masonry to be preferred; of the impracticability of the arch form, etc., the conclusions are reached that "a dam of such a length as the Quaker Bridge dam, if acting as an arch, would be subjected to excessive strains;" that "with the profile recommended, it can successfully resist, in all its parts, the pressures applied to it without any additional support;" that "if built on a curve it would not act as an arch, and would be more expensive;" that "it is advisable that the dam be built on a straight line."

The top of the parapet is fixed at an elevation of 13 feet above ordinary high-water mark.

The overflow, it is recommended, should have a capacity sufficient to carry off, in 24 hours, a volume of water equivalent to six inches depth over the whole watershed.

The following recommendation from Mr. E. S. Chesbrough is quoted with approval: "The superstructure should be composed throughout of uncoursed, broken range rubble masonry, built of quarry stone of irregular sizes, laid with full beds and joints. The use of cut stone should be confined to such appropriate ornament as may be desired, none being used in the body of the work, not only on account of expense, but also to avoid the introduction of two different classes of masonry. While, as above stated, coursing should be avoided, it would be proper to keep the work roughly leveled up over its entire lengthsay every five feet in height—so as to secure an even settlement as the structure goes up." To secure perfect bedding of the stones it is advised that none of them weigh more than two tons, and that most of them should weigh much less.

Imported Portland cement, mixed in the proportion of one part of cement to two of sand, is recommended in commencing the work in order to secure perfect connection of the structure with the rock, and also in the last season on the upper and final portions of the dam on account of its more rapid hardening in case the dam is subjected to full pressures immediately after completion.

For the bulk of the dam good domestic cement in the same proportions, or Portland cement with three parts of sand to one of cement, is expected to suffice.

Several valuable suggestions are added as to methods of construction and obtaining material. The reports are accompanied by interesting tables, diagrams, and illustrations both of proposed and existing work.

THE CONSTRUCTION OF BRIDGES OVER THE MUSKINGUM RIVER, OHIO.

A VERY brief report on this subject has been made to the Secretary of War by a board of engineers consisting of Colonel William C. Merrill, Major L. H. Beach, and Lieutenant C. E. Gillette.

It is gratifying to find that the matter of obstruction to the free navigation of streams is so carefully treated by the U. S. Engineers whenever they have an apportunity of so doing.

In the draft of a law submitted to Congress for the governance of these structures they have tried to meet the reasonable views of all parties. The locks being but 180 feet long and 34 to 36 feet wide, they consider that draws of two clear openings of 80 feet at water-line, and smooth crib-work or masonry projecting both up and down stream 100 feet from the axis to a height of four feet above highest locking stage to be sufficient. Continuous spans are to have a channel span of at least 250 feet, with a clear elevation above highest locking stage of at least 40 feet.

Before any bridge can be built, full notice of intention to build is to be given by publication in newspapers in the locality. Drawings of the bridge and piers, and the topography of the banks one-quarter mile above and below, with soundings, contour lines two feet apart, and current lines at high navigable stage and low water, are to be submitted to the Secretary of War. The Secretary is to appoint a board of engineers, or refer the matter to the engineer officer of the river. Said board or officer is to hold a public session at some convenient point, and, after full examination, report to the Secretary, who has full power of approval, rejection, or modification of the plans.

The full right is observed of subsequent alteration or removal of all structures without cost to the Government.

RESISTANCE OF STONE TO CONCENTRATED LOADS.

M. L. DURAND-CLAYE has been making at l'Ecole des Ponts et Chaussées some experiments on the crushing of blocks loaded on portions only of their surface, published in the A'evue Industrielle, that are of interest in their relation to structural conditions where a stone, as for instance a column base, is subjected to a more or less concentrated load.

In the experiments a square cut stone was supported completely on one surface and received pressure through a small square cast-iron block bearing against the centre of the opposite surface.

The results, though somewhat contradictory, did not vary much more than ten per cent., and furnished data (rather insufficient, it is admitted) for the formula P - RAa. P - total crushing pressure applied through small block; R - crushing strength per unit of surface of stone when uniformly loaded on whole surface; A - side of square stone, and a - side of square pressure-block.

In other words, the concentrated crushing load per square inch on the pressure-block is, other things being equal, inversely as the diameter of the pressure-block and directly proportional to the diameter of the stone. While this can hardly be absolutely correct for extreme proportions, it is perhaps a good working approximation.

Few, if any, experiments have been heretofore made in this particular direction, and the practical value of the results make it an inviting field for some original research.

REPORT OF THE WATERBURY WATER-WORKS.

THE twenty-first report of the Water Commissioners of Waterbury has been received. It contains the ordinary statistical record. The receipts for water rents for the year were \$48,728.33, being an increase of over eight per cent. There are 128 meters of various makes now in use. Some 3,486 feet of 16-inch and 5,600 feet of 18-inch iron pipe have been laid during the year.

As bearing on the use of cement water-pipe, the engineers (Messrs. Wetton and Bonnett) report respecting 1,500 feet of 12 inch cement-pipe, that its life or strength is gone, and it cannot be long before leaks will show themselves, hence they recommend that it be relaid.

This pipe has been in use, however, for a long time. Surveys and estimates have been made for an additional supply by a storage reservoir about five miles distant on Hop Brook. This will have a capacity of 400,000,000 gallons, and, with the necessary supply, is estimated to cost \$180,000. The water-shed has an area of about 2½ square miles.

A BIG PONTOON.

A MONSTER pontoon has just been completed at Dangar Island on the Hawkesbury River, in connection with the work now going on at the Hawkesbury railway bridge, for the purpose of conveying the heavy iron-work to be used in the construction of the bridge. The pontoon is built wholly of Oregon pine, and has a length of 340 feet, breadth of 61 feet, and depth of 10 feet 6 inches. The Union Bridge Co., of New York, are the contractors for the bridge.

ISTHMIAN MARINE TRANSIT.

THE Maritime Association of New York has asked Congress to adopt such measures as will enable private enterprise to open a route for Isthmian marine transit at the earliest possible day.

THE Holstein Canal, commenced last year, will, when finished, unite the North Sea with the Baltic, and will be of material service to commerce.

THE Kings County Elevated Railroad of Brooklyn is said to have made arrangements to run its first train through Fulton Street on April 1.

A SPEED of as much as 16 feet of completed tunnel in a day of twenty-four hours at one face has been attained in the tunnels under the Thames for the City of London and Southwark Subway, and at the present time about a mile and a half of the tunnels have been driven.

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ENGINEERS' CLUB OF PHILADELPHIA.

A MEETING of the club was held February 4. Past President L. M. Haupt in the chair, Howard Murphy,

Secretary; 19 members present.

Prof. L. M. Haupt submitted, with comments and explanations, the bill introduced in Congress relative to the establishment of a bureau of harbor and waterways, to be officered by a corps to be known as the Corps of U. S. Civil Engineers.

Civil Engineers.

The secretary presented, for Mr. Rudolph Hering, the preamble and resolution recommending the supply of automatic self-registering rain gauges at all U. S. Signal Stations, which had been passed by the American Society of Civil Engineers, and which, after some discussion, with the substitution of the name of the club, were adopted.

Mr. A. Marichal read a paper on "Rainfall," calling the attention of the club to the importance of continuous and detailed observations. The rainfall is one of the most capricious of phenomena, and unless our observations be very numerous and complete in detail, it is impossible to make any useful deductions.

The tables and diagrams required are numerous, includ-

The tables and diagrams required are numerous, including the rainfall all over a given country, per day, per month, per year, with corresponding height of barometer, temperature, and direction of wind; the rainfall compared with the stream flow; the rainfall compared with the sani-tary condition of cities and towns; in the case of an epi-demic, the rainfall compared with the progress of the dis-ease, and the rainfall compared with the age of the moon,

etc.
Mr. Marichal presented, also, diagrams showing the mean annual rainfalls over the world, ranging from 527 inches (Rhasia Hills, India) to 0 (Sahara and coast of Peru), and showing that the localities where an enormous rainfall was recorded were as unhealthy as those where only fifteen inches and less was falling annually; that, generally, the death-rate was a minimum where the rainfall was about 35 to 45 inches, as in Philadelphia, which is among the healthiest cities of the world; that the maximum rainfall was near full moon, and the minimum near new moon; that a 28 years' experiment in France, and a 20 years' one in Germany gave practically the same results.

Mr. A. Ely and others offered a resolution to the effect that the club approve and adopt the 24-hour system of time notation. Its consideration was postponed until the next meeting.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met February 15, President Ho'man in the chair, W. H. Bryan, Secretary; thirty members and four visitors present. Edward H. Connor, E. C. Parker, and Bathurst Smith were elected members.

On motion, the report of the Special Committee on the Waddell Pamphlet on Highway Bridges was taken from the table. After a very general discussion the matter was made the special order of the day for the next meeting.

Mr. O. L. Petitididier, presented a paper on "Practical

Mr. O. L. Petitdidier presented a paper on "Practical Notes on Masonry and Stone Laying." He called attention to the great antiquity of the subject and its interest to engineers. He mentioned many points of value in such construction, and necessary precautions to be taken. Among other points touched upon were mortar, cements, sand, pointing, expansion, laying, masonry, transportation, and plant. Messrs. Holman, Seddon, and Johnson took part in the discussion. Papers by Prof. II. B. Gale and S. F. Burnet were announced for the next meeting.

ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting of the club was held February 6, fourteen members and eight visitors present.

Mr. J. A. L. Waddell was elected as Treasurer, and Messrs. H. A. Lasley, A. W. Boeke, and F. L. Mills as members.

The paper of the evening, on "The Inspection of Iron Bridges and Viaducts," was read by Mr. B. L. Marsteller and discussed by Messrs. Goldmark, Chanute, Waddell, and Breithaupt.

The committee appointed to consider Mr. Waddell's pamphlet on "Highway Bridges" presented their report, and it was proposed to devote the regular meeting of April to a discussion of the pamphlet, and to invite several eminent bridge engineers and builders to take part.

ENGINEERS' SOCIETY OF WESTERN PENN-SYLVANIA.

THE regular monthly meeting of the society was held at Pittsburg February I. There was a very large attendance, delegates to the meeting of the National Electric-Light Association then in session in the city having been invited to meet with the society.

A programme appropriate to the occasion had been arranged in the presentation of a paper on "Electric Railroads," by Mr. R. McK. Lloyd, prefaced by a brief talk on "Electrical Terms and Methods of Measurement," by Prof. Altred E. Frost, of the Western University of Pennsylvania. Prof. Frost stated that one of the first by Prof. Altred E. Frost, of the Western University of Pennsylvania. Prof. Frost stated that one of the first questions asked about electricity is, "What is it?" and while this was something difficult to answer, while it might not be possible to tell what the thing is, we yet have means for measuring it. A parallel case might be found in trying to answer what is gravitation. We cannot tell what the force is that causes the pound weight to drop to the earth, but we have a means of measuring the force.

Electricity has now become something more than a mere plaything, the pith-balls of the school-room have given way to the many applications now made of this mysterious force.

He began with its simplest form of its development— by friction—explaining that the first of the terms used by electricians is what is called "the motive difference of poillustrating by means of reference to water-levels.

Then followed the production of electricity or the electrical state by two substances coming in contact, as in galvanic electricity; putting the zinc and copper in some acid which will act upon the zinc more than on the copper and in that way the "difference of potential," which was started by the mere contact, is maintained by the chemi-

Lastly he came to the dynamo and illustrated elabo-

rately how the electrical current was produced by it.

Turning to another term, he said we are accustomed to speak of a current passing through a wire. We do not know that anything is going on in the wire, but we do know a great deal is going on in the vicinity of the wire. We speak of the current going over the wire; of the wire offering a "resistance," which adds another term to our vocabulary. He illustrated this point by referring to a water-pipe, stating the wire was similar in this respect; that the larger the pipe or the wire, with the same amount of water or fluid, the resistance would be less than in a smaller pipe or wire; further, that the resistance is dependent not only on the diameter, but also on the length of the wire.

of the wire.

From the foregoing could be deduced the fundamental electrical formula C = E + R, which means, translated, the current strength is equal to the electro-motive difference of potential, divided by the resistance in the circuit. E is measured by a certain unit called a "volt," and "R" by a unit called an "ohm," the strength of the current "C" being measured by a unit called an "ampere."

But to return to the starting point we must learn to law

But to return to the starting point we must learn to lay aside the question, "What is electricity," and substitute for it, "What is it doing?" "What work is it performing? how measure it?" and then we shall have something tangible to work on.

tangible to work on.

Mr. Lloyd, in his paper on "Electric Railroads," gave a general description of the parts of such a road, with the manner of operating the same. He stated the amount of work obtained from the dynamo equaled eighty-five to ninety per cent. of the theoretical, while with the steamengine but fifteen per cent. was obtained.

Two plans were pursued in the operation of an electric railroad—either a constant current of varied intensity or a

Two plans were pursued in the operation of an electric railroad—either a constant current of varied intensity or a varied current of constant intensity. He recommended the latter, which was used by the road with which he was connected. He did not recommend the use of storage batteries, claiming they are expensive and unwieldy and do not produce adequate results. He believed that cars should be lighted by electricity, but all other electrical contrivances should be discarded as requiring more care and attention than results obtained would compensate. As to ice and snow, he had found in his experience that they interfered as much with electrical roads as with horse As to ice and snow, he had found in his experience that they interfered as much with electrical roads as with horse cars, but, all things considered, electric cars could be run for less than half the expense of horse cars, and at the same time afford the people better service. He stated that such ratlways could be built in any street in Pittsburg for \$25,000 per mile, while cable lines would cost \$100,000, and the cost of operation would be fifty per cent. less, while electricity is as reliable as either the mule or the cable

Dr. Moses, of the National Electric-Light Association, in a few remarks gave the development of the electric railway system abroad, stating its use was contemplated in the Underground Railway of London, the only system of rapid transit in that city. The conditions, he stated, of rapid transit in that city. The conditions, he stated, were all favorable, and he thought there was little doubt of the adoption of the system, and of an American system

In Paris, also, plans were under consideration, some of the features being novel. The cars are to be run on high tension currents in a multiple arc, and feeders are to be placed along the line for the purpose of supplying the current. To preserve these from the attacks of the small boy, the inventor has arranged that when the car reaches soly, the inventor has arranged that when the car reaches a certain rail it covers the vulnerable point, obtains its supply, and, when passing off the rail, the feeder is again covered and protected.

This plan is proposed in opposition to the cable lines, and he thought it would be approved.

MINNEAPOLIS ENGINEERS.

THE Minneapolis Engineers' Club met last week with a large attendance. A. H. Linton and George E. King were elected to membership. Messrs. Abbot, Sturtevant, and Huntress were appointed a committee on national public works. At the next meeting there will be a paper on the St. Paul Cable Line by E. T. Abbot.

THE BOSTON WATER-METER TESTS.

THE tests of water-meters begun by authority of the Boston Water Board in the latter part of April, the Boston Water Board in the latter part of April, 1887, were concluded in October, and the gentlemen constituting the commission to make the tests, Messrs. L. Frederick Rice, Charles Carr, and N. M. Lowe, have completed their report. There were thirty-five meters entered for testing, but only twenty-six were actually furnished. The results are presented by means of elaborate tables and analyses of the tests.

WORD comes from Connecticut that the present high pr. ce of coal has revived the cord-wood industry there and is keeping the wood-choppers very busy. Of recent years owing to the almost exclusive use of coal for fuel, there which it is to be hoped will continue.

HENRY KNICKERBACKER, JR.

HENRY KNICKERBACKER, IR., a graduate of the Rensselaer Polytechnic Institute of Troy, N. Y., in the class of 1887, and a young man who gave promise of a bright future, died suddenly at Saratoga Springs, N. Y., on February 13, aged twenty-two.

ENSIGN BENNETT.

ENSIGN BENNETT, better known as Col. Bennett, died at Buffalo, February 21. He was born at Portland, Chautauqua County, N. Y., on September 5, 1831, where he early developed a liking for engineering, and assisted in laying out the eastern end of what is now the Lake Shore and Michigan Southern Railway.

Coming to Buffalo, he became connected with the office.

Coming to Buffalo he became connected with the office

of the City Engineer.

Leaving Buffalo Col. Bennett went to Lyons, where he was appointed resident engineer of the Erie Canal. He was connected with this public work when its earlier limits were being changed for something more substantial. After the war broke out he entered the Government employ, and for a time he directed the construction of fortifications at Boston and Plymouth, Mass.

Colonel Bennett lived for a number of years at Brazil

Colonel Bennett lived for a number of years at brazil and Michigan City, Ind., and was extensively engaged in railroad building. Returning to New York he located at Rochester and built the Valley Canal Railroad, now part of the Western New York and Pennsylvania. This work finished, he continued his connection with the road by

taking charge of its coal interests.

He gave up railroad building and returned to Buffalo in the spring of 1882, since which he has been known as the General Manager of the Fairmount Coal and Iron Company, North-Western Coal and Iron Company, and the Buffalo Coal Company, all of which are owned by the above road. A widow and three sons survive him.

GEORGE H. CORLISS.

GEORGE H. CORLISS died suddenly in Providence, R.I., GEORGE H. CORLISS died suddenly in Providence, R.I., February 21. Mr. Corliss was born in Easton, Washington County, N. Y., June 2, 1817. In 1825 his father moved to Greenwich. After serving several years as general clerk in a cotton factory he spent three years in the Academy at Castleton, Vt., and in 1838 he opened a country store in Geenwich. He first showed mechanical skill in temporarily rebuilding a bridge that had been washed away by a freshet, after it had been decided that such a structure was impracticable. He afterward constructed a machine for stitching leather before the invention such a structure was impracticable. He afterward constructed a machine for stitching leather before the invention of the original Howe sewing machine. He went to Providence in 1844; in 1846 began the development of his steamengine improvements, having associated himself with John Barstow and E. J. Nightingale under the firm name of Corliss, Nightingale & Co.

Mr. Corliss won a large number of medals and had many honors conferred upon him. He carried away

Mr. Corliss won a large number of medals and had many honors conferred upon him. He carried away the highest competitive prize at the Paris Exhibition in 1867; was presented the Rumford Medals in 1870, the late Dr. Asa Gray, President of the Academy, making the presentation, and won the grand diploma at the Vienna Exhibition in 1873, although he had neither machinery nor representatives there. Foreign builders had, however, exhibited engines claimed to be built on his system, and the system won the award. In 1879 Mr. Corliss was awarded by public proclamation the Montyon prize of the Institute of France for 1878, which, in the Old World, is the highest honor known for mechanical achievements. In February, 1886, the King of Belgium made Mr. Corliss an officer of the Orcer of Leopold.

Mr. Corliss was a Commissioner for Rhode Island at

Mr. Corliss was a Commissioner for Rhode Island at the Centennial Exhibition, and was one of the Executive the Centennial Exhibition, and was one of the Executive Committee of seven that was intrusted with the preliminary work. He submitted plans for a single engine of 1,400 horse power to move all the machinery in the exhibition, which was completely successful. Mr. Corliss spent, it is said, \$10,000 upon it above the appropriation for building it. He was actively interested in public affairs, but kept himself out of public office, his only public service being as Presidential Elector for Hayes in 1876 and State Senator for several terms.

Senator for several terms.

He was often urged to run for Mayor or Governor and as often refused, once declining a nomination for Governor after a convention had unanimously tendered it. He was one of the commissioners who built the City Hallin Providence. Mr. Corliss was twice married, first in 1839 to Phebe F. Frost, of Canterbury, Coun., who died in 1859, and again in 1866 to Emily A. Shaw, of Newburyport, Mass. who survives him. He leaves a daughter and son by his first wife.

PERSONAL.

E. R. Jones, who has been connected with the Eastern Division for thirty-four years as Assistant Superintendent and Superintendent, has resigned his position on account of age and failing health.

DEXTER BRACKETT, who has been connected with the City Engineer's Department of Boston for the past nineteen years, has been appointed Superintendent of the Eastern and Mystic Divisions of the Boston Water-Works.

J. H. Brown, who has been Superintendent of the Mystic Department, has been placed in charge of the Mystic Valley sewer.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CHITECTURAL COMPETITIONS.

IINNEAPOLIS.—Plans for the new courtse and city hall have been opened. The iding will cost \$1,500,000. The scheme of ipetition was decided on as already noted hese columns, and twenty-six sets of plans e submitted. The award will be made r. The main plans and the styles of archiure proposed were as follows:

ure proposed were as follows:

'ost Brothers, Minneapolis—Rough and ssed stone, six stories high, with one centower 400 feet, and four towers; central inda, 112 feet square, finished in marble plastering, the general appearance being ilar to the Pittsburg Court-House.

V. H. Dennis—Romanesque design in

v. H. Dennis—Romanesque design in ssed stone, resembling the Pittsburg build; four stories high, with central and three all towers, and an open central court.

orff Brothers—French Gothic design, five ites and basement, with a high tower on the orth Street side.

Irth Street side. landy & Cady—Italian style, four stories, ha grand entrance on Fourth Street, of ssive appearance; also a French Gothic ign, four stories and basement, with two

ers and a portico.

& A. L. Haley—Renaissance, three stories l basement, with an imposing central dome ring a low clock.

Mex Murrie—Gothic building, four stories

Alex Murrie—Gothic building, four stories I basement; central tower and grand enace on Fourth Street, modeled after the result of Glasgow Scotland.

y Hall of Glasgow, Scotland.

V. D. Kimball & Co.—Four stories and ement, with a high arched entrance, a lare tower on Fourth Street, and an open it in the centre.

ong & Kees, two plans—One of classic le; H-shaped, four stories and basement, h large central dome and closed central int; the other of Romanesque style, ssed stone, with high tower on Fourth eet, two smaller towers opposite, high of and high arched entrance on the north

3. E. Hoover—Classic design, three stories I basement, square and plain, with large stral dome and entrance starting on the sement level.

Meyer & Thorn, St. Paul—Italian Romanque in style, four stories and basement, th roofs and entrance, with high tower Fourth Street, and a number of smaller vers

H. Maltby—Byzantine style, with central me and four smaller ones on the corners, d liberally ornamented walls.

Edbrook & Burnham, Chicago—Romanjuestyle, H-shaped, with main entrance resed on Fifth Street, large central tower, d winding stairway leading to a lookout at

J. Gast, San Francisco—Renaissance, four ries and basement and four towers.
C. F. Collum, Philadelphia—Design mas-

C. F. Collum, Philadelphia—Design masee, with central tower on the Fifth Street le.

M. E. Bell & Co., Chicago—Romanesque hitecture, five-story and basement in 1gh stone, large central tower and arched trance

McDonald Brothers, Louisville—Romanlue, four stories and basement, with high of and open court, relieved by a high tower the Fourth Street side.

the Fourth Street side.

E. E. Meyers, Detroit—Romanesque style, cidedly ornamental, rough stone exterior, th large tower on the north-west corner and nilar ones in the rear; high roofs and open ntral court from the fourth story to the sement.

STORM LAKE, IOWA.—Plans are wanted re for a court house, until April I. J. W. avren, County Auditor.

FALL RIVER, MASS.—The Fall River edical Society has addressed a communicant to the aldermen of this city calling their tention to the imperfect system of plumbing id se werage which exists in certain quarters, if which is, it claims, a fruitful cause of disses of typhoid and diptheritic type. It is to be that improvements in the system as be ordered by the city officials.

ALB ANY, N. Y.—It is proposed to improve adison Avenue, at a cost of \$250,000. A mail the chas been appointed who have the alter mader consideration.



For works for which proposals are requested see also the "Proposal Column," pages i-lv-viii-207.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtain ing early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

WHEELING, W. VA.—It is probable that the Board of Aldermen will soon take conclusive steps towards making the proposed improvements to the water-works system. The idea is to have one basin of 1,000,000 gallons capacity, to be used as a settling basin, the water to flow down an incline from it into the 2,000,000 gallons distributing basin. The total cost of the improvement is estimated at \$50,000.

MEMPHIS, TENN.—The new water-works company has about finished the plans and specifications for the \$75,000 improvement, and it is probable bids for the work, etc., will soon be advertised tor. The city engineer can give details of the proposed work.

FARMINGTON, ME.—Concerning the water-works question here, the chairman of the Board of Assessors writes us, under date of February 16, as follows: "The question is being agitated, and will probably be decided two weeks from to-day. I will try to send you the result."

LOCKLAND, O.—About \$15,000 is to be expended on the sewerage system here.

EDGAR, NEB.—A. A. Richardson, engineer, of Lincoln, Neb., is preparing plans and specifications for a system of water-works for this place to cost \$20,000.

ASHLAND, Wis.—The city will vote, on March 6, on the question of issuing the sum of \$100,000 in bonds for additional sewers and other improvements.

WILLIMANTIC, CONN.—Concerning the extending of the sewerage system here, our correspondent writes as follows: "Proposals are now being prepared and plans made for additional sewers, for which \$91,214 (estimated) will be expended. We have decided to use vitrified earthenware tile, and have estimated the amounts needed as follows: 1,320 feet 8-inch, 960 feet 15-inch, 280 feet 18-inch, 600 feet 20-inch, 2,880 feet 24-inch, and 620 22x-32 brick. G. W. Meloney, of the Sewer Committee, can give details."

SOUTH FRAMINGHAM, MASS.—Our correspondent writes: "The result of the election held here February 20 to determine whether or not the sum of \$140,000 should be expended on a sewerage system resulted in favor of the project. The Committee on Sewerage was instructed to petition the State Board of Health to affirm its plans, and in six weeks we expect to be ready to receive bids."

CHAUTAUQUA, N. Y.—Concerning a published report that water-works were to be erected here, our correspondent writes as follows: "No water-works as yet proposed."

CANYON CITY, COL.—Concerning the report that the water-works here were to be improved, our correspondent writes as follows: "The State Penitentiary is located here, and the State Commissioners are putting in waterworks for the prison, which they have pretty well advanced towards completion, but the plant is a very temporary one."

TECUMSEH, NEB., will vote on honds for water-works February 28. Amount of bonds, \$21,000. Plans and specifications by A. A. Richardson, engineer, of Lincoln, Neb.

ABERDEEN, DAK.—The Pullman pumping system has been adopted for the sewer-work. The approximate cost is to be \$40,000.

FORT BENTON, MONT.—Our correspondent writes: "Water-works have been established here and are about ready for operation. They are the Holly system, and were put up by George F. Woolston, of Boston, Mass."

OWATONNA MINN.—Concerning the waterworks question here our correspondent writes as follows: "A petition of citizens has been presented to the Council asking for some system of water-works. The petition was referred to the Fire Department Committee in whose hands it now is. The chairman of this committee is James Brown."

IRON MOUNTAIN, MICH.—Concerning the water works project here our correspondent writes as follows: "Estimates have been made. The question of bonding the city in the sum of \$85,000 was submitted to the people February 14, at which election there were only thirty votes cast against it out of a population of about 5,000. Contract will be let April 2. Plans and specifications are being prepared by O. Burlingame, Menominee, Mich."

READING, PA.—Our correspondent writes: The City Council, at its next meeting, will introduce an ordinance to divide the city into sewerage districts, and at once commence the erection of said new sewers, as an appropriation of \$45,000 has been made for said purpose."

ALBANY, N. Y.—The agreement between the Central-Hudson road and this city relative to certain lands to be secured by the latter for water-works is about ratified. The railroad desires to obtain title to the waters and lands under the waters of Patroon's creeks from the southerly line of the lands of the company near the culvert, about 1,500 feet east of the Russell road, to the southerly line of the lands of the company near the culvert opposite the west end of Tivoli Lake. For these lands \$50,000 is to be paid the city to lay a trunksewer for the company, into which the city can drain if it sees fit. The railroad company will allow the special water commission to cross, either above or below its tracks, with a force-main to carry water from the gang-wells now being sunk on the flats near the Hudson River, north of the city of Albany, at a point to be determined hereafter.

YANKTON, DAK.—City Council will adopt plans for \$4,000 system of sewerage.

ROCHESTER, MINN.—C. F. Loweth, C. E., of St. Paul, has been selected to draft plans for a complete system of sewerage. Work is to be commenced this summer.

GERMANTOWN, PA.—A movement has been made by the taxpayers towards improving the sewerage system. A resolution declaring the entire system a nuisance prejudicial to public health was adopted by the Board of Health, and a request was made to Councils to furnish means for abating it as early as practicable. It is probable that immediate steps will be taken towards the end desired. Medical Inspector Taylor can furnish details.

DULUTH, MINN.—At a recent meeting of the directors of the Duluth Gas and Water Company steps were taken to secure the construction of a new and larger reservoir. In addition to this, the general work of laying mains, etc., throughout the city will be continued.

FAYETTEVILLE, N. C.—Concerning th water-works project here our correspondent writes as follows: "This town wants a modern system of water-works. Enough interest is felt in the subject to favor a local company to put in the plant; but no one here seems to know exactly how to manage it. One or two proposals have been made on the 'franchise plan,' but the matter is still open. The Town Board appointed a 'water-works committee,' which has the subject under consideration. No specifications have been adopted as yet; water-supply near by, pure and abundant. The town will at an early day employ a competent engineer to survey its streets and to make estimates for a canal by which the water of the Cape Fear River can be brought through the town, thus augmenting its present fine water power."

Los Angeles, Cal.—The Tiyunga Water Company has been incorporated in this city. Capital, \$500,000. F. C. Garbutt and others, incorporators.

HAYWARD, WIS.—The Hayward Water-Works Company was incorporated February 16, with a capital stock of \$50,000. E. H. Holbert is at its head.

WATKINS, N. Y.—Carrol Ph. Bassett, of Newark, N. J., has been engaged to prepare plans and report on water-supply and sewerage systems for this place.

LANARK, ILL.—Address D. S. Licht, City Clerk, for details of new water-works project.

PEABODY, MASS.—The water-works system here is to be improved.

OGDEN, UTAH—It is proposed to improve the water-works system.

ELKTON, MD.—Water-works will probably be constructed here. John S. Wirt is chairman of the committee in charge.

ST. IGNACE, MICH.—It is reported that water-works are contemplated here.

RED JACKET, MICH.—Joseph Herman is at the head of a committee to investigate the feasibility of establishing water-works.

PAINESVILLE, O.—Concerning the published report that water-works were to be erected here, A. N. Peebles, engineer of the Painesville Water-Works, writes us as follows: "I am not aware of any new system of water-works contemplated for Painesville. There is a very good system of water-works here, of which Mr. B. F. Stephens, of Flatbush, N. Y., is superintendent and general manager."

BRIDGES.

BELLEVILLE CITY, CANADA.—A \$60,000 bridge is to be constructed by the city over Quinte Bay.

LONG LAKE, N. Y.—Concerning a report that a bridge was to be erected here our correspondent writes as follows: "A small bridge is to be erected here, but there is no prospect of anything being done at present."

ASHTABULA, O.—Address the County Commissioners for details of a bridge to be erected by them.

MAURICETOWN, N. J.—The Cumberland County Freeholders have decided to erect an iron bridge costing \$50,000 over the Maurice River at this place.

STREET-WORK AND PAVING.

ST. PAUL, MINN.—The Board of Public Works has reported favorably on considerable street work, and bids will soon be asked for doing the work. The total cost of the improvements is \$125,200.

WASHINGTON, D. C.—The Street Committee is considering the question of appropriations for paving several streets, and it is probable that the work will soon be ordered done.

GAS AND ELECTRIC-LIGHTING.

DELPHI, INDIANA.—An electric-light plant is to be established here.

FREMONT, NEB.—This place is to be lighted by electricity.

JACKSON, OHIO.—An electric-light plant is to be established here.

NORTHAMPTON, MASS.—An electric-light company is being organized here.

OSWEGO, KANSAS.—The Oswego Electric-Light Company has been incorporated. Capital, \$60,000. F. L. Greene and others, incorporators.

MEDFORD, MASS.—The Medford Electric Light Company has been incorporated; capital, \$20,000. William H. Warren and others, incorporators.

EVERETT, MASS.—The Everett Electric-Light Company has been incorporated; capital, \$10,000. F. S. Pearson, Treasurer.

DAVENPORT, KY.—The People's Light Company has been incorporated; capital, \$10,000. James Thomson and others, incorporators.

TAUNTON, MASS.—The electric-light plant at this place is to be extended.

NEWPORT, R. I.—An electric-light plant will probably be established here.



Dover, N. H.-An electric-light company has been organized here, with F. Abbott its president. The capital stock is \$75,000.

WATERVILLE, ME. - The Waterville Electric-Light Co. will expend several thousand dellars on improvements.

CANTON, O.—This city will shortly advertise for bids for 20, 30, 40, and 50 electric lights, from 150 to 300 gas lights, and from 400 to 800 gasoline lights. Address the Committee on Street Lighting.

MANCHESTER, N. H .- The officials of this place are discussing the question of purchasing an electric-light plant. The plan is to be considered further at the next meeting of the Common Council.

FREDERICK, MD.—The New York Electric Construction Co. has offered to light the streets of this place for \$4,000 per year. The offer has not been accepted, and the officials are still considering the matter.

DULUTH, MINN.—It is probable that additional lighting facilities will soon be wanted

in this city.

The question of making a change in the system of manufacturing gas, with the idea of providing a better service, was considered by the directors of the Duluth Gas and Water Co. at a recent meeting. With this object in view, Manager Craig has left for Chicago, and will probably also go to Buffalo, to inspect the parious systems in operation and the plants various systems in operation and the plants used, the idea being to secure the most improved plant for the new works to be erected here.

BROOKLYN, N. Y .- The Edison Electric-Light Company has applied to the Mayor and Common Council for permission to open and Common Council for permission to open the streets and to lay its conduits, cables, and wires. It promises, in case the franchise is granted, to furnish the city and the citizens with incandescent electric-lights twenty-five per cent. cheaper than the present service.

FLATBUSH, N. Y.—A difference exists between the Flatbush Gas Company and the Highway Commissioners which may result in a break of contract between the two parties. The town has heretofore paid \$31 a year per lamp, but now the officials declare that they will not pay more than \$25. The gas company will not sign a contract at that figure and the matter remains unsettled.

BIDS OPENED.

ST. PAUL, MINN.—The contract for the steam-heating of the new St. Paul, Minneapolis and Manitoba Railway office building has been awarded to Allan Black, of this city, for

CINCINNATI, O .- Synopsis of bids for furnishing, etc., at the Front Street pumping sta-tion an amount of boiler power equivalent to tion an amount of boiler power equivalent to the evaporation of 36,000 pounds of water per hour, and at the Hunt Street station one of 15,000 pounds per hour, opened February 16 by the Board of Public Affairs. Bids on Front Street boiler: Dun & Laidlaw Co, Cincinnati, O., Galloway boilers, evaporation, 12, \$20,795; Abendroth & Root, New York City, Root boilers, evaporation, 10.95, \$21,603.40; Charles Ward, Charlestown, W. Va., evaporation, 8, \$20,000; Home Safety Boiler Company, St. Louis, Mo., evaporation, 9, 5, \$17,115. Hunt Street, Dun & Laidlaw Co., \$10,430; Abendroth & Root, \$9,965; Charles Ward, \$9,500; Home Safety Boiler Co., \$7,250.

MOUNT CARROLL, ILL.—Our correspondent writes: "The U. S. Wind Engine and Pump Co., of Batavia, Ill., received the contract of furnishing machinery, materials, and construction of a water-works system for our city, February 15, at the amount of \$15,200.

CHICAGO, ILL.-The firm of Riter & Conley, Pittsburg, Pa., has received a contract from Mr. Onderdonk, the contracter who has secured the job, to supply this city with purer water. They will construct a large caisson for the purpose of being sunk four miles out in the lake to be used in the tunnel extension. The outside caisson will be 75 feet in diameter, the intermediate one 31 feet. The entire transmill be 66 feet by the crongly broad. mass will be 60 feet high, strongly braced with bars, angles, and T-iron, and will weigh tons. Carnegie, Phipps & Co. will supply the firm with the steel.

The work will cost from \$25,000 to \$30,ooo. After the caisson is sunk in the lake four miles out, a tunnel will be commenced at that point and dug under the water until the present tunnel is reached. The same firm will also build the second caisson.

FINDLAY, O .- The following bids for furnishing water-works materials were opened February 15 by the water-works trustees, John W. Hill, of Cincinnati, O., Consulting Engineer:

John W. Hill, of Cincinnati, O., Consulting Engineer:

Cast-iron water-pipe and specials—2,627.69 tons of 2,000 pounds, 114,000 pounds of specials. Addyston Pipe and Steel Co., Cincinnati, \$70,074.40; Hueston & Freeman, \$70,074.40; Lake Shore and Foundry, Cleveland, \$72,089.63; Ohio Pipe Co., Columbus, \$75,253.97; W. H. Campfield, \$75,253.97; National Pipe and Foundry Co., \$78,710.33; R. D. Wood & Co., Philadelphia, \$79,075.24; Dennis Long & Co., Louisville, \$33,301.77; Mellert Iron and Foundry Co., New York, and Reading, Pa., \$86,170; Builders' Iron and Foundry Co., Providence, specials, \$2,600.

Pipe-laying and concrete—5.370 feet 20-inch, 7,770 feet 16-inch, 1,450 feet 14-inch, 4,310 12-inch, 10,913 feet 10-inch, 16,636 feet 8-inch, 38,136 feet 6-inch, 5,016 feet 4-inch; concrete, 55.63 cubic yards, James J. Rumsey, \$22,820.71; W. H. Campfield, \$25.537.69; P. Sullivan, \$26,355.33; A. G. Pugh, \$27,785.61; Snyder & Williams, \$28,316.20; Hueston & Freeman, \$33,920.05; P. E. Sullivan, \$37,168.65; Vanston & McCarthy, \$38,398.48.

Stop-valves—2 20-inch, 218-inch, 56.6-inch, and

\$38,398.48.
Stop-valves—2 20-inch, 4 16-inch, 1 14-inch, 3 12-inch, 12 10-inch, 21 8-inch, 56 6-inch, and 8 4-inch. James Flower & Bros., Detroit, \$2,086; Galvin Iron and Brass Works, Detroit, \$2,086; Galvin Iron and Brass Works, Detroit, \$2,130.50; Bourbon Copper and Brass Works, \$2,222; Ludlow Valve Co., Troy, N. Y., \$2,224.80; Eddy Valve Co, Waterford, N. Y., \$2.263.50; Chapman Valve Co., Indian Orchard. Mass., \$2,338.47; Hueston & Freeman, \$2,357; Holly Mfg. Co., Lockport, N. Y., \$2,566.50; Mellert Foundry Co., New York and Reading, Pa., \$2,400.

\$2,505.50. Henert Foundry Co., New York and Reading, Pa., \$2,409.

Stop-Boxes—207 required—Galvin Iron and Brass Works, \$267.50; Bingham & Taylor, \$346.10; Eddy Valve Co., \$347.75; A. W. Morgan, \$337.05, \$353.10, \$371.29; Hueston & Freeman, \$481.50; Mellert Pipe and Foundry Co., \$1,605; Builders' Iron and Foundry

& Freeman, \$481.50; Mellert Pipe and Foundry Co., \$1,605; Builders' Iron and Foundry Co., \$321.

Fire-hydrants—133 16-inch hydrants, 6 4-inch hydrants—Without frost-cap, Ludlow Valve Co., \$3,716.94 and \$3,949.69; Chapman Valve Co., \$4,162.42. With frost-cap, Galvin Iron and Brass Works, \$4,140; Ludlow Valve Co., \$4,231.24, and \$4,255.64 without frost-cap; Bourbon Copper and Brass Works, \$4,548; Bourbon Copper and Brass Works, \$4,548; Galvin Iron and Brass Works, \$4,557; Chapman Valve Co., \$4,633.05; Bourbon Copper and Brass Works, \$4,823; Mellert Foundry Co., \$4,835; Ludlow Valve Co., \$4,898 90; R. D. Wood & Co., \$4,925.75; Bourbon Copper and Brass Works, \$4,932; Hueston & Freeman, \$4,953; Holly Mfg. Co., \$5,161.50; James Flower Bros., \$5,281.90; Holyoke (Mass.) Hydrant Works, \$5,405.89; Bourbon Copper and Brass Works, \$5,479 and \$5,754; Chapman Valve Co., \$5,787.49; Ludlow Valve Co., \$5,974.07; Eddy Valve Co., \$6,020. Without frost-cap, Chapman Valve Co., \$5,113.22; Ludlow Valve Co., \$5,13.19.

Co., \$5,213.19.
Pumping Machinery—2 2,500,000 gallon com. duplex non-condensing pumping with 3

com. duplex non-condensing pumping with 3 66'x16' boilers complete.

Gordon & Maxwell Mfg. Co., "A," \$15,-600; Gordon & Maxwell Mfg. Co., "B," \$14,700; Holly Mfg. Co., "A," \$21,700; Holly Mfg. Co., "B" (rotative), \$24,700; Deane Steam Pump Co., Holyoke, \$27,700; Cooper Mfg. Co., \$18,300.

Proposals for pipe, specials, hydrants, stop-valves, stop-boxes, pipe-laying and concrete complete:

complete:
Snyder & Williams, \$108,674.42; Hueston & Freeman, \$112,085.59.

CINCINNATI, O.—Synopsis of bids for the excavation, concreting foundations, brick work, cut-stone work, iron work, copper and slate work, interior concreting, fire proofing and asphalt for the erection of the proposed new City Hall, opened February 20, by the Board of City Hall Trustees. The bidders were as follows:

were as follows:

Excavation—John Sperry, \$4,950; John Sperry (concrete), \$6,486; Henry Dieckman, \$5,300; Geo. S. Gleason, \$3,500; F. H. Schroder & Son, \$4,164; Henry Sweeney, \$3,300; James O'Malley, \$7,683.

Excavation, Concrete and Foundation—H. Meiners & Son, \$2,1000; foundations P.

Meiners & Son, \$34,900: foundations, P. Murry & Son, \$22,850; foundations, John Sperry, \$29,858; excavations, concrete and foundation, P. Murry & Son, \$33,237; foundations and concrete, D. Flaherty & Bro., \$36,550; foundations, J. H. Finnegan, \$25,-

545. Brick Werk—Jacob Megley & Son, \$87,844; J. M. Blair's Sons, \$75,275; N. C. G. Parker,

\$ 76,661 (additional at rate of \$11 per 1,000); J F. Tuttle & Son, \$85,384; Cornell Fuerst. J F. Tuttle & Son, \$85,384; Cornell Fuerst, \$74,547 (additional at rate of \$11 per thousand); C. E. Iliff, \$78,000 (additional at \$12 per 1,000); Mason & Bro., \$85,575 (additional \$11 per 1,000); H. Jacob & Holscher, \$80,339 (additional \$11 per 1,000); McGarvey & Bro., \$78,175; H. B. Lucky & Son, \$84,637.

Cut stone-work—William Graveson, \$329,-998; David Hummel, \$326,500; foundation concreting, Pugh & Stagge, \$4,308; concrete interior, Charles Kuhl, \$18,915,04; foundation and interior concrete. Frank Bauer. \$27,038

interior, Charles Kuhl, \$18,945.04; foundation and interior concrete, Frank Bauer, \$27,938; foundation concrete, P. Gleason, \$7,750; interior concrete, P. T. Scabill, \$10,475; interior concrete, Pugh & Stagge, \$11,941; foundation concrete, J. H. Finnegan & Co., \$7,176; interior concrete and fire-proofing. L. Grace, \$32,979; foundation concrete, H. Dieckmeier, foundation and interior concrete and \$6,525; foundation and interior concrete and fire-proofing, Pugh & Stagge, \$45,560; interior concrete, Whitson & Pickering, \$14,-

500.
Fire-proofing—Pugh & Stagge, \$29,611;
Summit Brick Co., \$28,230; J. H. Finnegan & Co., \$18,645; William B. Owen, \$30,000;
Wight Fire-proofing Co., \$22,293.40; Pioneer

Vignt Fire-probling Co., \$22,293.40; Floheer Co., \$19,900.

Iron-work—Snead & Co., Louisville, \$141,-850; Haugh, Ketchum & Co., Indianapolis, \$132,000; L. Schrieber Sons & Co., \$130,890; M. Clements, \$125,700; Lane Bros., Newark, O., \$134,390.
Galvanized iron, copper, and slate-work—

Thomas Lee, \$32,860.
Copper, Slating, etc.—Witt Cornice Com-

22,000. pany, \$22,000.
Slating—James Hunter, for Monson slate, \$15,573; Peach Bottom, \$14,633; Franklin Tunnel, \$13,576; Old Bangor, \$13,458, and

Virginia, \$13,223.
Copper—James Hunter, \$4,275.
Copper and Slate—Witt & Brown, for Monson slate, \$21,635, and if Virginia is used deduct \$2,000; C. Kiechler & Son, Monson, Tunnel, \$18,908; Thomas Lee, Monson, \$33,676, Franklin Tunnel, \$31,641.
Asphalt—George L. Peabody, \$3,495; F. Schillinger, \$2,900; Samuel J. Osborn. Jr., \$3,625.

\$3,625.
The bids for the work complete were, Isaac Graveson & Son, \$529,777; David Hummel, \$508,900; Drirer Bros., \$587,538; James Griffith & Sons, \$596,630.

The bids were all submitted to the architect

for computation, and he will report to the Board at the earliest practicable time the lowest and best bidders for the several kinds of work. The award or awards will then be made and immediate work be begun upon its construction.

CANTON, O .- The following bids for lighting the streets for a period of two years from March I were opened by the Common Council February 20 and were referred to the Committee on Public Lights: Canton Schuyler Electtic Light Company to furnish 2,000 candle power arc lamps and keep them in repair, power arc lamps and keep them in repair, lights to burn from sunset to sunrise, at the following rates: 20 lamps, per month, each, \$11; 30 lamps, per month, each, \$6; 40 lamps, per month, each, \$8.50; 50 lamps, per month, each, \$8.25; 100 lamps, per month, each, \$8.25; 100 lamps, per month, each. \$8.

Canton Gas Light and Coke Company, to furnish lamps on the present gas mains and those in contemplation, will light and extinguish the lamps, lights to burn from sunset to sunrise twenty days in each month under Brey high pressure, six foot burners or any other high pressure, six foot burners or any other suitable governor burner at the annexed rates: 150 lamps, per year each, \$21; 200 lamps, per year each, \$20; 250 lamps, per year each, \$19; 300 lamps, per year each, \$18; 350 lamps, per year each, \$17; 400 lamps, per year each, \$15. The price of \$15 on 400 lamps stipulates the exclusive lighting of the streets and abolishing of all electric and gasoline lamps. of all electric and gasoline lamps.
Sun Vapor Light and Stove Company, Can-

Sun Vapor Light and Stove Company, Canton, to place their improved patent gasoline burner in the present street lamps, light the lamps, which will burn from sunset to sunrise, at 6¾ cents per post per night. If the city contracts for 400 lamps or more the price will be reduced to 6¼ cents. The company will also furnish new lamps at \$2.50 for the lantern, \$1 for the post, and fifty cents for planting the post and lamp.

HERLIMER N. V.—The following hide for

HERKIMER, N. Y .- The following bids for constructing a complete system of water-works were opened February 18 by the Board of Village Trustees:

Bids for works complete—John Lockwood, New York, \$52,711; Adam Miller, Saratoga, complete except pumping-engine, boiler, and stand-pipe, \$32,500; Moffett, Hodgkins & Clark.

\$47.222.18; Dennison Cowell, Muse Iowa, complete except stand-pipe, \$26. Bids for stand-pipe—Rogers & McDen Waterloo, \$7,000; Pancoast & Roger Vork, \$7,500; Whittier Machine Co., Srz., \$8,000; Porter Manufacturing Co., Srz., \$7,150; Hall Pump Co., Wilmington is \$9,350; P. S. Curtis, Utica, \$6,600, Srd., S \$47.222.18; Dennison Cowell, Mesc. \$9,350; P. S. Curtis, Utica, \$6,600, S. Harrison, Howard & Co., St. Louis, \$1. Beckwith & Quackenbush, with four: \$8,000; Van Zalle & McCormick, \$5,570; Union Iron-Works, Chatta: Tenn., \$7,775; Charles Millar & Soa, \$6,700; Bassett Bros., Buffalo, \$6,400; P. & Doyle, Mohawk, \$8,700.

& Doyle, Mohawk, \$8,700.

Boiler and engine—P. S. Curtis, 1 boiler, F. O. B., \$750; Rogers & Mcl. Waterloo, N. Y., boiler, \$750; Pance Rogers, New York, boiler, \$500; Porter Regions, 100; Porter Rogers, New York, or Syracuse, boiler, \$00; Porter Regions, \$2,750; H. R. Worther, New York, engine, \$2,750; Robert Picker Green Island, N.Y., boiler, \$655; Hall we Pump Co., boiler with dome, \$1,050; Hall we Pump Co., engine, \$2,450; George F. Lengine, \$2,375; Beckwith & Quackenbush, \$1,000; Deane Pump Co., we York, 22 and boiler, \$6,000; Van Zalle & McCornick, 25 and boiler, \$6,000; Van Zalle & McCornick, 25 and 26,000; Van Zalle & McCornick, 26 and 26 ooner, *900; van Zalle & McCormick p. ing-engine, \$2.640; Union Iron-Works, t. \$725; Union Iron-Works, pumping-st. \$2,300; Volker & Felthousen, Buffato, et and boiler, \$4,295; Charles Millar & \$2,300; Volker & Felthousen, Bultao, eq and boiler, \$4,295; Charles Millar &-boiler and engine, \$2,800; Bassett &-boiler, \$750; Bassett Bros., engine, 3p. Brown and Doyle, boiler, \$1,000; bra Doyle, engine, \$2,300.

Iron pipe, hydrants, etc—Pancoast & R. hydrants. \$23 and \$24.03; water gates \$9; 6-inch, \$13.93; 8 inch, \$20.29; pipe 8: 90 per ton; specials, 23/2 cents.
Ludlow Valve Co., Troy, 8-inch to

Ludlow Valve Co., Troy, 8-inch at \$20.50; 6-inch, \$13.70; 4 inch, \$8.40; inch, \$24.84 and \$26.34.

Mellert Foundry, Reading, Pa., 10 inch pipe, \$30; net ton, 6-inch, \$11.40 \$32; specials, 23/2 cents; valves, 4-inch \$6 inch, \$15; 8-inch, \$20; hydrants, \$2; inch \$20. \$30.

Chapman Valve Co., Indian Orchard, water

4-inch, \$9; 6-inch, \$13.73; 8-inch, \$20.25 drants, \$23 and \$24.03. Union Hydraulic Co., Philadelphia drants, \$28 and \$32; gate valves, 8-inch. \$175; 6-inch, \$12; 4-inch, \$8.10; check rane

\$33. Warren Foundry, pipe, 10-inch, \$119.5 inch, \$33; 6-inch, \$33.25; 4-inch, \$19.5 gross ton.

George Chambers, Rochester, pipe. \$3 per gross ton; specials, .024 cents; nytars \$24.80 and \$26.34; valves, 8-inch, \$0.50 inch, \$13.70; 4-inch, \$8.40; check vice

Howard Childs & Co., Pittsburg, pipe &

per net ton, specials 3c.
Eddy Valve Co., Waterford, valves 45
\$8.11, 6-in. \$13.95. 8-in. \$20.25, hydro
\$25.50 and \$26.
Beckwith & Quackenbush, pipe \$15.50

gross ton, specials 4c., valves, 4·in. \$10. \$16, 8-in. \$32, hydrants \$30 and \$35. Charles Millar & Son, Utica, pip \$1.57 gross ton, specials 2½c., hydrants \$20.807 \$31, valves, 8-in. \$21, 6-in. \$13, 4·in. \$21

check valve \$21, carting pipe 500 per 10a.

Bassett Bros., Buffalo, pipe \$33.7 for gross ton, specials 21/c.

Moffett, Hodgkins & Clark, pipe \$11.5

ton, specials 23/c.
R. D. Wood & Co., pipe \$31.60 per state of \$31

R. D. Wood & Co., pipe \$31.00 pt surface, specials 2½ c., hydrants \$28 and \$33. Brown & Doyle, pipe \$31 per gross specials 3c., hydrants \$24.80, valves \$2.18. Masonry, wood-work, and excavalves John Nelson, Herkimer, excavation states the state of the surface and states house 10.600 st pipe, 25 cents per yard; boiler-house, 30 kg foundation stone, laid, \$3, 25 per yard; 0. work, \$12.50 per M.; chimney, \$15.40 M.; water table, 65 cents per foot; doors

M.; water table, 65 cents per foot; doxing \$1.25; shingles, \$5 per square; trenching cents per foot; carpenter work, \$520.
W. S. Bascot, New York, trenching refilling, 14 cents per foot; laving pipe, becents; carting, \$1 per ton; hydrans revalves, \$2,012.26.

Serviss & Mack, Herkimer, boilet-base and chimney. \$2,500; excavating 35 cents for

and chimney, \$3.500; excavating 35 cents of yard; stone work, \$4; brick, laid, \$13.50 %.

M.: water table, 50 cents per foot; carpeting work.

work, \$1,000; painting, \$60.

J. P. Crim, Richfield Springs, trends refilling, laying pipe and carting, \$5.00 pt rod.

Beckwith & Quackenbush, trenching an

pipe-laying, 25 cents per yard; carting.

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ts per ton; boiler-house and chimney, 500 = setting hydrants, \$4.

DeG raff & Charles, Amsterdam, trenching refilling, 21c.; laying pipe, 10-inch, 22c.; ach, 10 ½c.; 6-inch, 10c.; 4-inch, 7c.; cart. 50-c. per ton.

Tharles Bates, Herkimer, furnishing and

ng stone, \$5 per yard; brick laid \$14 per; cut stone laid, 80c. per foot.

harles Millar & Son, excavation, 25c; con-e, \$4 per yard; stone-work, \$4.80; brick i, \$15 per M.; wood-work, \$36.24 per 1,000 c; doors, \$136; windows, sash, etc., \$84; er-table, 90c.; trenching and filling, 22c.;

dr. rable, 90c.; trenching and ming, 22c.; ing pipe, 9c.; carting 50c. per ton.

assett Bros., Buffalo, excavating, 20c. per d: concrete, \$4: stone-work, \$5; boilerise and stack, \$4,500; trenching and reng, 11c.; pipe laying, 10 inch, 17c; 8 inch, .; 6 inch, 9c.; 4-inch, 7c.; carting, 45c. per

3rown & Doyle, excavating, 40c. per yard; 1crete, \$5; stone-work, \$4.40; brick laid, per M.; wood-work, \$39.50 per 1,000 feet; prs, \$70; window and sash, \$10; waterle, 55c; shingles, \$6 per square; trenching table; problem to 15c; cartle, 55c; sningles, to per square, community in felling, 13½c; pipe-laying, 10½c; cart, 90c. per ton; pipe-covers, \$4.

All the bids are to be considered and the

stract awarded at a later meeting of the

GOVERNMENT WORK.

DEROIT, MICH .- Abstract of proposals for

DEROIT, MICH.—Abstract of proposals for milding the tower of Skilligallee light stan, Michigan, opened February 20 by S. unsfield, Major of Engineers, Bvt. Lieut.-1., U. S. A.:
Charles Sundberg & Co., Chicago, Ill., 875; Stout & King, \$44,238; Thomas ayden, \$18,500; Robert Dunn, Detroit, 225; William E. Avery, Detroit, \$7,725; seph L. Gearing, Detroit, \$7,694.

BROOKLYN, N.Y.—The following bids for ork on the addition to the Federal Building rk on the addition to the Federal Building re opened February 21 by the Supervising chitect of the Treasury Department: Cox Dady, Brooklyn, agreed to do the work in o working days for \$38,477.55; Bernard Illagher, Brooklyn, \$44,500, sixty days; A.Murphy, Brooklyn, \$51,900, six months; cCarthy & Baldwin, Washington, \$43,000, t months; John Pierce, Maine, \$47,000, months

DENVER, Col.-The following bids for ams, girders, etc., for the Court-House, re opened February 16 by the Supervising re opened February to by the Supervising chitect of the Treasury Department: arke, Raffen & Co., \$12,150; Dearborn undry Co., \$11,230; Colorado Irou Co., ,000 first and second floor, \$3,500 third and tic floor—total, \$12,500; L. M. Morris, 3,076; Pennsylvania Construction Co., I, I42.

NEW ALBANY, IND .- The following bids NEW ALBANY, IND.—The following bids r materials, tools, and labor for plumbing id gas-piping at the Court-House were ened February 21 by the Supervising Archict of the Treasury: J. F. Dalton, \$3,846.50; took, Horner & Co., \$4,900; John O'Neal & m. \$3,779; O'Connor & West, \$8,991; Ryan Wainderlich, \$7,800.

WASHINGTON, D. C.—The following bids r piles, lumber, sand, pebbles, and broken one, for the reservoir outlet were opened ebr uary 23 by Peter C. Haines, Lieut.-Col. Emgineers:

Time bids for piles were as follows: For 200 foot piles—Charles S. Beebee, 7c. per foot; A. Clarke, 14%c. per foot; Breen & Feely,

For 600 60-foot piles—Beebee, 7c. per foot; larke, 14 %c. per foot; Breen & Feely, 12c. er foot.

For 200 65-foot piles-Beebee, 7c.; Clarke,

15c.; Breen & Feely, 12c. For 600 cubic yards of pebbles—E. E. Bur-nughs, \$1.20 yer yard; Breen & Feely, \$1.80; M. Miller, \$1.74; J. E. McCracken, \$1.25, 151.15 if unloaded in three days.

For 800 cubic yards broken stone-D. L. hoe maker, \$1.55 per yard; 15 cents less if the Government will be responsible for care of essel; H. P. Gilbert, \$1.75, or \$1.45 if fur-ished vessel; G. B. Clarke, \$2.70. For 18,432 feet B. M. lumber—F. N.

mit h, \$34.50 per 1,000.
For 5 600 cubic yards of sand—Breen & tel., \$1.20 per cubic yard; E. E. Burroughs, 5 cents; R. M. Miller, 95 cents; J. E. Mc-rac Leen, 99 cents; G. B. Clark, \$1.50.

KESOKUK, IOWA.—The following bids for ron columns, first story, iron-work of sec-nd and third floors and third-story ceiling, ron, slate, copper and galvanized iron-work

of roof, terra cotta fire-proofing, etc., for court-house were opened February 16 by the Supervising Architect of the Treasury De-

Geo. W. Corbett, \$23,000; Haugh, Kitcham & Co. Iron Works, \$19,689.23; Heuson Robinson, \$21,239; Dearborn Foundry Co., \$24,-

FORT WAYNE, IND .- The following bids FORT WAYNE, IND.—The following bids for plumbing, water, and gas piping the court house were opened February 21 by the Supervising Architect of the Treasury Department: J. F. Dalton, \$2,85c; Crook, Horner & Co., \$4,077.08; Madden & Co., \$2,475; Herbert L. Rose, \$3,479.60; John O'Neal & Sons,\$3,398; A. H. Hattersley & Son, \$2,697.54.

BALTIMORE, MD .-- The following bids for covering projecting courses of stone work of towers with copper for the Post Office were opened February 16 by the Supervising Architect of the Transport Post Office were tect of the Treasury Department:

Bartlett, Hayward & Co., \$1,125

The bids for the interior of the building

were as follows:

	Amount for Mahogany and Pine.	Amount for Cherry and Mahogany Pine.	Oak and Pine.	Addition'l for floor'g per sq ft.
Philip Walsh & Son	\$117,754 00	100,999 00	\$94,341 00 \$0 111/2	\$0 111/2
McCarthy & Baldwin	27,548 00	118,788 00	114,732 00	13
John Moore	98,000 00	97,000 00	95,500 00	10
James H. Carter	132,466 20	112.964 50	105,197 40	6
Olter, Dunker & Co	121,300 00	105,000 00	98,400 00	12
Charles Ogle & Co	104,000 00	94,742 00	92,300 00	6
Dobart Witchell Fire Co	108,108 00	100,518 00	94,208 00	ï

Building Intelligence.

WR solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house; apar neithouse: ten, tenement; c, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

236-238 Spring st, s s, br factory; cost, \$35,000: o, The Bradley & Currier Co. (Limited); a, James Finlay.

43-45 Walker st, ss 315 ft w Broadway, warehouse; cost, \$68,000; o, Maria J Schermerhorn; a, C C Haight.

Hester st s s, 50 e Baxter, br ten and stores; cost, \$18,000: o, Jonas Weil and Bernard Mayer; a, George B Pelham.

50th st, n s, 100 ft w 10th av, br factory; cost, \$40,000; o, Hopper S Mott; a, Henry Davidson.

52d st. n.s. 150 ft w 10th av. br stable and ell; cost, \$14,000, o, Geo Widden; a, Geo B Pelham.

318-320 E 57th st. 2 bk flats: cost. \$22,000 each; o, Fred Heerlein; a, Berger & Baylies. 83d st, s s, 206 ft e 1st av, bk ten; cost, each, \$14.000; o, Maria Ueckermann; a, Edward Wenz.

W s oth av, 25 s 84th, 3 br flats; cost, \$60,000, all; o, Margaret A Brennan; a, Thomas

435 Greenwich, br stable; cost, \$15,000; o, Emil I Folliner; a, Rentz & Lang.

Rear 8 Liberty pl, assay office; cost, \$20,000; o, Henry M Platt; a G W Platt; b, Stephen D Hatch.

ALTERATIONS-NEW YORK.

6 Bowling Green, extension; cost, \$15,000; o, John L Cadwalader.

4th av, n e cor 80th st, br extension; cost, \$10,000; o, John A Prigge, a, J A Webster.

S w cor Market and Division, br bldg; cost, \$7,500; o, Mark Hammerschlay, a, Herter

BUILDING INTELLIGENCE.

51-53 William, br office bldg; cost, \$10,-000; 0, G A, P H & F M Adee; a, Mackay & Davis.

BROOKLYN.

Stuyvesant av, ne corner Macon st, br stone store and dwell; cost, \$10,000; o, a and b. A Miller.

268 Manhattan av, e s, 150 ft s Calyer st. br store and ten; cost, \$8,000; o. John Lynagh; a, A Hefbert.

N s Greene av, 90 w Central av, 9 frame dwells; cost, \$22,500 all; 0, Mrs L Singer; a, David Acker & Son.

S s Kent st, 79 w Manhattan av, br apart house; cost, \$12,000; o, John Englis & Son; a,G M Walgrove.

S s 19th st, 270 w 7th av. 9 fr dwells; cost, \$17,200 all; o and a, Kay & Bull.

BROOKLYN-ALTERATIONS.

W s Manhattan av, s w cor Kent st, 3 brick buildings; cost, \$8,000; o, John Englis & Son; a, G M Walgrove.

MISCELLANEOUS.

HOT SPRINGS, ARK-The sum of \$500,ooo is to be expended on a hotel and other buildings to be erected here by a company with S W Fordyce at its head.

SEDANSVILLE, O-A \$25,000 church is to be erected here by St Mary's Catholic Church Society.

FREMONT, O—A church building is to be erected here for the Methodist Episcopal Society. For details address Rutherford B Haves.

COUNCIL BLUFFS, IOWA-Ten buildings are to be erected here at a total cost of \$30,-000. For details address Dr. Macrae, the

BRAINTREE, MASS—The repair shops of the Old Colony Railroad are to be located here and \$250,000 will be expended on the necessary buildings.

READING PA-Penn and 6th, 3-story br bldg, b s trimmings; cost, \$12,000; Pennsylvania Trust Co; a, H Kendall.

5th and Elm, 2-story church and chapel: cost, \$23,000; o. St Matthew's L Congregation; Mr George Freese is the President, Mr Billheimer, Pastor

Penn st, bet 6th and 7th sts, 3-story br bldg; cost, \$9,000; o, H Koch; a, Wm

Penn and 2d sts, 2 br dwells; cost, \$9,500 o, M Link; a, E Mull; b, E Wenrich.

ST. PAUL.—Sherman, nr Franklin, 2-story fr dwell; cost, \$8,000; o, J T Averill.

EAU CLAIRE, WIS .- The Wisconsin Central contemplates building a new depot.

ST. LOUIS, MO .- 22d and Howard sts, br store and dwell; cost, \$7,500; o, C Bruck-hardt; b, H Drees.

20th and Pine sts, br warehouse; cost, \$8,500; o, Cratwell & Co; b, R P McClure.

MILWAUKEE, WIS. -\$40,000 has been raised to build a new First Baptist Church

KANSAS CITY, MO.—24th, cor Balto ave. 2 fr houses; cost, \$8,000; F C Marsh.

33 bldgs costing less than \$7,000.

SPRINGFIELD, MASS.—Railway stations. comprising 3 buildings, each 60x275 feet, stone, cost, about \$100,000 each; o, B & A RR; a, Shipley, Rutan & Coolidge.

DALTON, MASS.—Granite railway station, 22x50 feet; cost, \$10,000; o, B & A RR; a, Shipley, Rutan & Coolidge.

NEW BERNE, N. C .- The House Committee on Public Buildings has made a fa, vorable report on the bill appropriating \$75,000 for a public building for this place.

NEW LONDON, CONN.—A building is to be erected on the site of the old New Lon-don House at a cost of \$25,000.

SOUTH EASTON, PA .- Centre Street, 4 br houses; cost, \$2,000 each; o, Dr. Jiner; a, J M Stewart; b, not given out.

NEW HAVEN, CONN .-- Cor Water and Carlisle, br dwell; cost, \$7,:00; o, J S Johnson; b, L V Treat & Son.

Dwight, near Whalley av, br Llock; cost, \$8,000; o, G M Baldwin.

BUILDING INTELLIGENCE.

HARRISVILLE, PA.—Architect Kauen-geiser, of Youngstown, O., is preparing plans for a church to be erected here at a cost of \$10,000.

KANSAS CITY, MO .- 45 buildings costing less than \$7,000.

WAKEFIELD, MASS.—A \$50,000 Congregational Church is to be erected here.

POTTSVILLE, PA.—City Treasurer Whalen can give details of a \$300,000 court-house to be erected here.

BALTIMORE, MD.—Carey nr Fayette, 3 3-story br bldgs; o, H C Smyser.

DAYTON, O.—Cass and Clay, br church (German Lutheran); cost, \$10,000; a, Peters & Burns; b, not let.

SEA BREEZE, N. Y .- A hotel is to be erected here, to cost \$25,000.

WELLINGTON, KAN .- A union depot is to be erected here, to cost \$22,000.

GRAND RAPIDS, MICH. - Lyon, proof brick and stone warehouse and sales-room, six stories; cost, about \$50,000: o, Nelson & Matter Furniture Co; a, W G Robinson; b, contract not let.

College av. veneered dwell, frame up; cost, \$10,000; o, E W Withey; a, W G Robinson; b, Rowson Bros.

CHICAGO, ILL.—361-63 Ashland av, br dwell; cost, \$15,000; o, E P Wilce; a, Parmantier; b, W D Price.

2,040 Wentworth av, br store and flats; cost, \$3,000; o, Adam Schmidt; a, J M Schroeder; b, Anderson & Crozier.

233-37 Lincoln av. br store and flats; cost, \$30,000; Joseph F Schnoorolo; a, owner; b, Miller & Rumly.

2,358 Wentworth av, br store and flats; cost, \$9,500; o, Theo Hagedon; a, Wm Bargerbush; b, Thelon Bros.

150-64 W Madison, additional story to business block; cost, \$18,000; o, John M Smyth; a, Strippelman & Co.

1,089 Milwaukee av, br store and flats; cost, \$10,000; o, John Jensen; a, Henry Kley; b, owner.

Kley; b, owner. . 25-29 State, 6 story br warehouse; cost, \$60,000; o, Jonathan Clark; a, Flanders & Zimmermann.

Cor Butler and 24th, br factory; cost, \$20,000; o, Matthias Dencer. a, J A Thain. 5t bldgs costing less than \$7,000 each.

MENDOTA, ILL.—Br brewery; cost, \$30,-000; o, C Henning; a, Griesser.

WAUKESHA, WIS .- A Catholic Church will be built here to cost \$30,000.

ST. CLOUD, MINN .-- First National Bank will put up a \$30,000 building.

ST. PAUL, MINN.-The Board of Managers of the St. Cloud Reformatory decided at a meeting in this city to advertise for bids for the proposed building; \$100,000 to be expended.

A \$20,000 block of stores and flats will be erected at the corner of Selby Avenue and St Albans Street.

DULUTH, MINN.—Among the new buildings contemplated are: E E Dickerman of St Paul, a block of five stores; Franklin school building, to cost \$20,000, Palmer & Hall, architects; Munyer & Markell, fourstory wholesale goods warehouse; a fine row of terrace residences by Dr Walbank; in the Endion Division, ninety new residences; the syndicate block to be built by J A Willard and others, of Mankato and Duluth, to cost \$175,000.

PEORIA, ILL.—A Y. M. C. A. building is to be erected here at a cost of \$100,000.

BLOOMINGTON, ILL.-A \$30,000 Baptist Church is to be erected here.

FRENCHTOWN, O.—A Catholic church to cost \$25,000 will be erected here.

MOUNT GILEAD, O.—Burgoyne & Wilson will rebuild their carriage factory destroyed by fire February 20; loss, \$16,000.

LOWELL, MASS.—The Board of Trade has sent to Washington a long petition for a \$250,000 Government bldg.

A new city hall bldg is again proposed to cost \$500,000. Digitized by GOOGLE

BUILDING INTELLIGENCE.

KENT'S HILL, ME.-A \$25,000 seminary is to be built here.

EAST BRIDGEWATER, MASS.—Rogers & Sheldon will rebuild their iron-works here to replace those destroyed by fire February 18; loss, \$75,000.

NORTH WILBRAHAM, MASS. — The Collins' Paper Mill will be rebuilt at a cost of \$75,000.

MILWAUKEE.—New Chicago and Northwestern depot, Wisconsin street. The contract for moving the old depot 200 feet south has been let. The new building will be proceeded with at once at a cost of \$250,000, and will be of brick and sand-

N s Juneau av, bet Cass and Marshall, br school; cost, \$10,000; o, All Saints Ca-

232 Juneau av, brick council hall; cost, \$12,000; o, All Saints' Cathedral.

12 buildings less than \$7,000.

PHILADEL PHIA, PA.-Bambridge, bet Penn and Swanson, 5-story iron bldg 96x48; o, Harrison, Frayies & Co; b, H Doris.

Elsworth, w 26th, 2 dwells; o, William Elkins

Hope, above Norris, 3 dwells; o, R B Clark.

Chelton av and Green, dwell.

Elsworth, w 26th, 3 2-story dwells; o, Geo Mink.

1604 Bodine, 3-story dwell; o, Patrick Saggert.

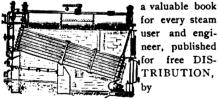
Watkins, bet 20th and 21st, 7 2-story dwells; o, James Donaldson.

WORCESTER, MASS. — Nothing over \$7,000 to report this week.

PROVIDENCE, R. I.—\$300,000 worth of new buildings will be put up here in place of those destroyed by fire February 16 corner of Eddy and Fountain streets, Chace's block and others.

WESTERLY, R. I.—\$150,000 worth of new buildings will be built here.

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quirements, and invite a critical examination of our new system of construction by all who contemplate purchasing boilers

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Correspondence solicited.

28 CLIFF STREET, NEW YORK.

THE THOMAS GIBSON COMPANY of Cincinnati, O., who were the first importers and manufacturers of sanitary fixtures, have introduced a new closet, The CAR-LISLE PEDESTAL, "front outlet," the distinctive features of it being SIMPLICITY, PERFECT WASH, scientific construction, and moderate cost. A handsome circular and price-list will be furnished on APPLICATION.

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Cabinet Makers and Decorators.

EXCEPTIONAL facilities for the manufacture of fine Architectural Cabinet Wood-Work and Interior Decorative Work from the designs of architects and our own artists.

An inspection of our Warerooms is solicited.

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Horn, Brannen & Forsyth Co. Manufacturers of

GAS FIXTURES. ELECTROLIERS AND ART BRASS WORK.

427-33 North Broad St., PHILADELPHIA, PA

PROPOSALS. (Continued from page viii.)

ELECTRIC-LIGHT.—Proposals are wanted at Fairhaven, N. Y., for erecting, etc., an electric-light plant. No date specified. Address the Mayor.

DREDGING.—Proposals are wanted at Cleveland, O., until March 1, for dredging in the Cuyahoga River. Address Walter V. Rice, City Engineer.

STREET WORK.—Proposals are wanted at Hol-yoke, Mass., until March 2, for paving, curbing, etc. Address Henry Winkler, Chairman, Committee on Highways.

DREDGING.—Proposals are wanted at Jersey City, N. J., until February 29, for dredging, crib-work, and rip-rap, to be done in Morris Canal Basin. Address the Engineer's Office, L. V. R.R., Washington Street,

STEAM-HEATING.—Proposals will be received by the School Trustees for the Ninth Ward, New York City, at the Hall of the Board of Education, No. 146 Grand Street, until Monday, March 5, for steam-heating apparatus to be placed in the Annex Building for Grammar School No. 3, in Grove Street.

BRIDGE.—Proposals are wanted at Fond du Lac, Wis., until March I, for erecting an iron bridge across the Fond du Lac River. Said bridge to be of iron, sixteen feet roadway in the clear, and sixty-one and one-half feet long, in one span, with sidewalk each four feet eight inches wide on each side, and of ample strength for all kinds of road traffic. Address E. Delany, Jr., City Clerk.

RETAINING WALL.—Proposals are wanted at Jefferson City, Mo., until February 29, for about 60,000 cubic feet of masonry, range work and cut-stone work. Address J. B. Legg, architect, Governor's office, as

FIRE-ALARM TELEGRAPH.—Proposals are wanted at Mobile, Ala., until March 31, for furnishing, erecting, etc., a fire-alarm telegraph system, containing 40 signal boxes, 9 engine-house gongs, 2 private gongs, 25 miles of wire and other apparatus to make the system complete. Address John F. Summersell, City Clerk.

TOWER.—Proposals are wanted at Albany, N. Y. until March 1, for the erection, etc., of a stone tower for the Cathedral of the Immaculate Conception. Address Messrs. Withers & Dickson, architects, Albany, N. Y.

PROPOSALS.

Proposals for Building Sewers.

Proposals for Building Sewers.

TRENTON, N. I., February 25, 1888.

THE Common Council of the City of Trenton, in the State of New Jersey, will receive, at their meeting, to be held in the City Hall of said city, on Tuesday, the twentieth day of March, A. D. 1888, at eight o'clock in the evening, sealed proposals for building in said city the following-nemed sewers:

A main sewer with about two thousand feet of vitrified pipe of fifteen inches diameter, about two thousand feet of egg-shaped brick sewer from 18226 of to 2924 and 42 about four hundred feet of cast-iron pipe 24 and 42 diameter, about five hundred feet of vitrified relief-pipe 12 and 15 diameter, and with fifteen mac-holes and flushing-basins.

Also a pipe-sewer about eight hundred feet in length, 8 and 10 diameter, with two man-holes.

Also a pipe-sewer about three thousand feet in length, 8 to 20 diameter, with nine man-holes and flushing-basins.

Also arain-water drain, to be an egg-shaped brick structure about thirty-three hundred feet in length, from 1710 x2 9 to 40 x5 0, with thirteen man-holes and flushing-basins, and eighteen inlets.

Also arain-water drain, to be an egg-shaped brick structure about one hundred and seventy-five feet in length and about 3 2 x4 9.

Plans and specifications, with a draft of the contract, and of the bonds required to be given, may be seen at the office of the Engineer, at No. 18 West State Street, Trenton, N. J., on and after March 6, 1888.

Each proposal must be made on a blank form, which will be furnished by the City Clerk, and must be accompanied with a satisfactory bond, with at least two surcties, in the sum of five hundred dollars, conditioned that if the proposal be accepted the person or persons making it will execute the coctract required to be furnished within five days after the acceptance of the proposal.

Separate proposals must be made for each of the above-mentioned sewers, but any person submitting

furnished within five days after the acceptance of the proposal.

Separate proposals must be made for each of the above-mentioned sewers, but any person submitting proposals for two or more sewers may stipulate thereon that he shall not be bound to execute any contract unless all of the proposals made by him shall be accepted by the Common Council.

The proposals must not be filed with any city official, but must be delivered by the bidder, or his agent, to the Common Council, at their meeting, above mentioned, when the same shall be called for by the President of the Common Council.

The Common Council reserves the right to reject any or all proposals.

By order of the Common Council. Dated February 23, 1888.

W. W. L. PHILLIPS, 14

Proposals for City Building.

Proposals for City Building.

THE undersigned will receive bids until noon of SATURDAY, MARCH 17, 1888, for the erection of a new city building at a cost not to exceed \$35,000.

Bids to be accompanied by plans and specifications, and marked "Proposals for City Building."

JOHN D. KIEFER,

Chairman of Committee.

Urbana, Ohio, February 23, 1888.

Proposals for Electric Light. Proposals for Electric Light.

THE undersigned will receive bids until noon of SATURDAY, MARCH 17, 1888, for the furnishing and maintaining of fifteen (15) to forty (40) street arc lights and too incandescent lights and operating the same for a period of one to five years. Proposals to be addressed to the undersigned and marked "Proposals for Electric Light."

By order of the City Council.

OBED HORR, City Clerk.

Urbana, Ohio, February 23, 1888.

ELECTRIC LIGHTS.—Proposals are wanted at Hagerstown, Md., for lighting the public streets, etc., by electricity. No date specified. Address the Street Commissioners.

SUPERSTRUCTURE.—Proposals are wanted at Minneapolis, Minn., until March 7, for constructing 273 feet iron superstructure and the necessary abutments and piers for superstructure of the proposed bridge over the Manitoba and St. Louis railroads. Address Andrew Rinker, City Engineer.

IRON TOWER.—Proposals are wanted at De Moines, Iowa, until March τ, for furnishing the materials and erecting an iron tower, according to specifications. Address S. A. Robertson, Superintender of the Court House Building Committee.

WATER-WORKS.—Proposals are wanted at Avon, N. Y., for a system of water-works. No date specified. Addless O. Sackett, Town Clerk.

WATER-WORKS.—Proposals are wanted at Fay-etteville, N.C., for a system of water-works. No date specified. Address F. O. Rose, Chairman Water-Works Committee.

PAVING.—Proposals are wanted at Kansas City, Mo., until March 31, for about eight miles of spruce and cedar-block paving. Address City Clerk, Lang-

worth.

MISCELLANEOUS SUPPLIES.—Proposals are wanted at the U. S. Military Academy, West Point, N. Y., until March 16, for supplying the Academy with building material, gas and steam-fitting, printing and printing material, chemicals, chemical and electrical apparatus, books and stationery, stone, lime, cement, etc., according to specifications. Address Charles W. Williams, Assistant Quartermaster, U. S. A., Disbursing Officer.

PIER.—Proposals are wanted at New York City until March 6, for removing a part of Pier (old) 36, North River, and the shed thereon, and for building a new wooden pier, near the foot of North Moore Street, Address the Department of Docks, Pier 1, North River.

ALTERATION.—Proposals are wanted at New York City, until March 8, for the alteration of the Willard Parker Hospital, East Suxteenth Street. Ad-dress James C. Bayles, President Health Department.

ELECTRIC FIRE - ALARM. — Proposals are wanted at Washington, D. C., until March 7, for the introduction of an electric fire-alarm call and police patrol system into the Treasury Building. Address C. S. Eairchild, Secretary Treasury Department.

PROPOSALS.

Louisville Water-Works.

TO CONTRACTORS.—Scaled propused dressed to the President and Directors of the valle Water Co., and endorsed "Proposal for the Inlet and River Work," will be received at the desaid company, 540 Third Street, Louisville, 12 o'clock M., of Monday, the second day of 1888, and at that time will be opened and rais a presence of the bidders or their representing a therein, whether as individuals or biness fractions therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as individuals or biness fast therein, whether as a required check the sum of pany in case of a refusal for any reson to present the company of the stated both as a words and figures. Any bid submitted disruss be declared informal and rejected. The papersons to whom the contract may be awarded. Bits made upon the accompanying blank form in the upof which the price must be stated both as a words and figures. Any bid submitted disruss the work has been awarded to him or the, as acceptable bondsmen as sureties, and create the tract within six days from the date of noticitions the work has been awarded to him or the, as a case of failure or neglect so to do be or they acceptable bondsmen shall with the specifications, can be examined at the Company's office, from p. A. M. to 5. M., until the bids are opened. Not less than two bads with the specifications, can be examined at the Company's office, from p. A. M. to 5. M., until the bids are opened. Not less than two bads with the required from the party to whom the one with a submitted of the bondsmen shall ke know the submitted of the submitted of the bondsmen shall ke know the submitted of the submitted of the submitted of the submitted of the submitte

posaís submitted. LOUISVILLE WALEA VERANY, by Charles R. Long, President.

TO BUILDERS OF PUMPING MALEA COMPANY, by Charles R. Long, President.

To BUILDERS OF PUMPING MALEA COMPANY, by Charles R. Long, President.

Directors of the Louisville Water Company, all dorsed Proposal for Pumping Engine, will be made at the office of the Louisville Water Company, all dorsed Proposal for Pumping Engine, will be made at the office of the Louisville Water Company, all dorsed the company of the proposal submit to obtain the will be opened and read in the present of bidders, or their representatives, Bidders are residences of all the parties interested therein, who as individuals or business firms and companies, close a certified check in the sum of ten the series of the company of the company of the company of the company of the parties of the Water Company of the company of the company of the company of the company of the company of the company of the contract and bond, on the part of any written words and figures. Any bid submitted wise will be declared informal and rejected. The son or persons to whom the contract may be asswell be presented as the contract may be asswell be presented as the contract may be asswell be presented as the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract within aix days from date of any office, with acceptable bondsmen as surtext, and cute the contract of the contract. The sufficiency, solveny, and louisiness standing of bondsmen shall be acc

THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE PROPOSED BUREAU OF PUBLIC HEALTH

THE Committee on Commerce of the House of Representatives is disposed to report favorably to the House the bill to establish a Bureau of Public Health in the Department of the Interior introduced by Mr. Davis, of Massachusetts, being H. R. bill No. 1526.

This is the same bill that was before the last

Congress, being the one prepared by a committee of the American Public Health Association and endorsed by that body. It is also approved by the Association of State Boards of Health.

It provides for the appointment of a commissioner of health with a salary of four thousand five hundred dollars per year. He is to obtain and furnish information with regard to the sanitary condition of ports and cities both in this country and abroad, and is to have investigations made into the causes and means of prevention of disease.

The only opposition to the bill is from Dr. Hamilton, the Chief of the Marine Hospital Service, who wishes to perform these duties himself and to be known as the chief sanitary official of the United States. The motives for his hostility are so frankly personal and selfish and the objections to placing public health matters under his control are so strongly felt by the great majority of State and municipal health officers that it might be supposed that his opposition would have little weight. It must be remembered, however, that for the last six or seven years Dr. Hamilton has been able to prevent the formation of a national public health organization, his position being that if such an organization is not under his control it is needless. The chief reason why he has thus been able to defeat the efforts of the sanitarians of the country is because these sanitarians have not been agreed as to what they wanted. Some wanted a board, others a bureau; some want the United States to control quarantine, others that the Federal authorities shall have nothing to do

From the beginning of the agitation on this subject, ten years ago, this journal has maintained that this country ought to have a Central Bureau of Health, that a Commissioner is better than a board, that this bureau should not be under the control of the Marine Hospital Service or of the Army or Navy Medical Departments, and that its best and most useful work would be the promotion of scientific investigations into the causes of disease with a view to its prevention. This bill is, therefore, one which we heartily approve, and one which we advise not only sanitarians and medical men, but those having commercial interests at heart to support by communicating with members of Congress and Senators and urging its passage.

PROPOSED APPROPRIATION FOR EN-LARGEMENT OF THE ERIE CANAL.

A BILL has been introduced into the New York Legislature proposing an appropriation of \$1,000,000 to start an improvement of the State Canal System, at an ultimate "estimated" cost The proposed dimensions of the of \$5,000,000. locks of the Erie Canal are to be: length, 220 feet; width, 18 feet, and depth, 9 feet. The plan is in accord with the recommendations of the Canal Improvement Convention held at Rochester last summer.

While there is no doubt that the Erie Canal should be enlarged, a serious protest should be made against the adoption of the plan proposed; that is, commencing the enlargement by an appropriation of \$1,000,000. An expenditure which a non-professional convention "estimates' amount to \$5,000,000, without any data to show that it will not be \$15,000,000 before completion, is altogether too serious a matter to be undertaken without consultation with the State's constitutional professional advisor, the State Engineer and Surveyor, and the presentation of a full and detailed estimate covering the cost and advantages of the proposed enlargement and any alternative plan that may be presented.

THE DRINKING-WATER OF VIENNA.

THERE is no large city in Europe which has a more satisfactory supply of drinking-water than that which Vienna now possesses and has enjoyed since 1874. Prior to that date the supply of the city was largely from wells, of which there were 10,000 in 1861. The water from these wells was found in 1859 to be polluted, containing organic matters and infusoria of various kinds.

Besides these wells, the city had a limited general supply taken more or less directly from the Danube, and the water from a few springs was distributed to a few palaces and public buildings. Work was commenced on the new water-works in 1870, and in 1886 only eleven per cent. of the houses were using well-water or any other supply than that brought in by the new works from mountain springs and lakes. The water from the Danube is only used for watering and cleansing the streets.

The daily supply of pure drinking-water in 1886 was about 130,000 cubic metres for a population of 764,000, or about 170 litres (37 gallons) per head. The result of this improvement in water-supply upon the health of the city is interesting, and has been made the subject of several statistical investigations, of which the latest is by Dr. Mosny, published in the Revue d'Hygiene for January, 1888. Dr. Mosny discusses more especially the statistics of the typhoid fever in Vienna in relation to the watersupply, showing that the mortality from this cause has steadily diminished from 2.2 per 1,000

inhabitants in 1857 to 0.2 per 1,000 in 1884-86. The following table shows the difference in mortality from this disease between houses which have and those which have not the best spring water-supply:

	PERCENTAGE OF DI	RATHS FR	OM TYPHOID IN HOUSES.	
Years.	Having Spring Water	Not Having Spring Water- Supply.		
1874		1.73	3.11	
1875	During epidemic.	1.97	4.21	
1875		1.40	2.86	
1876	1.30	2.75		
1877	18 7 7	1.38	4.50	
1877	During epidemic.	1.04	10.00	
1878		1.01	1.98	
1879		1.13	1.21	
1880		0.86	1.21	
1881		1.04	0.70	
1882		1.03	0.69	
Mean.	•	1.26	3 02	

In the epidemic of typhoid which broke out Vienna in 1877 the proportion of deaths to nhabitants was nearly ten times greater in those houses supplied with water from the Danube than it was in those furnished with the pure supply. Among the soldiers located in barracks in different parts of the city the number of cases of typhoid per 100 men in the barracks supplied from the Danube was 2.69, while in those having the pure water-supply it was 0.15.

The evidence is very strong that typhoid fever in Vienna has been connected with the water-supply, and that those who make use only of the present general supply run very little risk of taking this disease. Cases are now rarely seen in the hospitals, and when they do come it is almost invariably from some suburb to which the general supply has not yet been extended. Dysentery has also nearly disappeared, no deaths from this cause having been reported for the years 1881-86, and the whole statistical record gives excellent evidence as to the good effects produced by an unpolluted water-supply.

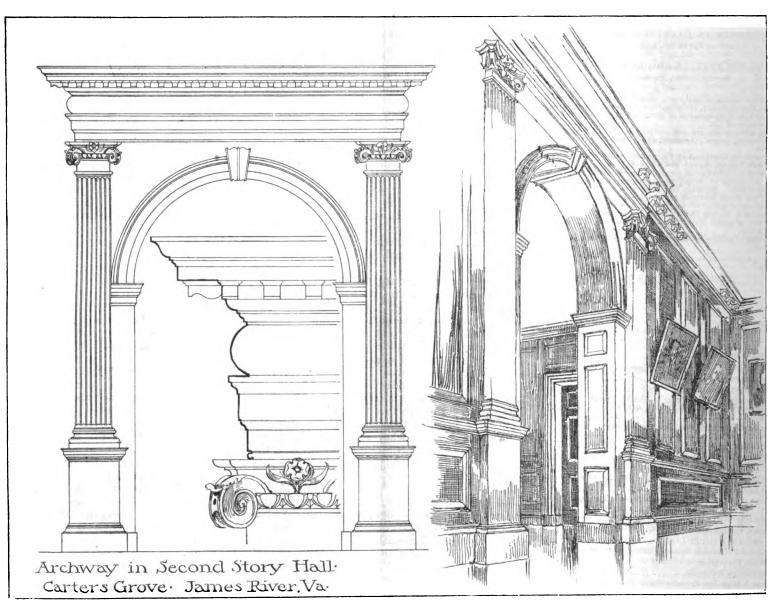
London bounded by Cheapside and Fleet Street on the north, and Queen Victoria Street and the Embankment on the south, at a cost of £26 per lamp, instead of the full cost of about £40, in consideration of a concession of the exclusive right of way for their electric lighting lines, etc., for private lighting for a term of not less than seven years. The total charge for the proposed 169 arc lamps for street lighting would be £4,394, representing an addition to the city rates of about one-eighth of a penny in the pound.

The development of electricity in its application to carriers has found a new instance at Brighton. Mr. Volk, who has for some time past exhibited an electric railway there, has recently exhibited an electric dog-cart. The trap weighs forty pounds, and with a load of two persons has given a speed of four miles an hour on a macadamized road. On smooth surface it gave better results. It is fitted with a ½ H.P. Immisch motor, situated under the trap, the current being supplied by 16 E. P. S. accumulators.

while standing in the pipes, they keep their water running to waste, so that it shall not stand. The Corporation are publishing statements showing the enormous and unac counted increase of consumption.

The Directors of the Great Northern Railway have recently issued an order to their firemen and engine-drivers which should be the imitation of similar regulations throughout the various railways in the country. No fireman or engine-driver is to be allowed to go on duty unless he has had at least nine hours' rest. Such an instruction should not be necessary, but being necessary, its issuance is no less a boon to the men than a source of safety to the public.

A question as to whether it is necessary and profitable to burn pyrites in the open air is creating considerable discussion in Spanish mining circles, and especially at the Calanas Mine. The municipal authorities, exercising what one should take to be an undoubted right, prohibited the burning on sanitary grounds, owing to the



FAVORING IMPROVEMENT OF NEW YORK CANALS.

PRESS dispatches from Buffalo state that the bill appropriating a million dollars for the improvement of the canals is receiving endorsement from all the leading institutions and business interests. Preparations are making for a monster mass meeting. Efforts will be made to interest New York in the gathering and to secure speakers from that city.

SOME FOREIGN NOTES.

(From our London Correspondent.)

THE Anglo-American Brush Electric-Light Corporation has made the first serious attempt to cope with the difficulties created by the Electric Lighting Act. It is probable that the A. A. B. Co. reckon on the assurance pretty generally entertained in electric light circles, that the "old iron clause" will be repealed by the present Parliament session.

At the meeting of the City Commissioners of Sewers, held on the 14th inst., the Streets Committee reported that the A. A. B. Co. have offered to light a section of

A new microphone transmitter has just been patented in Vienna. The principle is a series of hollow carbon cones within each other, the object being a frequent change of surfaces in contact. Siemens & Holske are the patentees.

The Finsbury Technical Institute is being well worked. A series of lectures, illustrated by working drawings and dynamos, and in connection with a Jrawing class, is announced, the subject being the mechanical engineering involved in the manufacture of dynamos and motors. Professor Perry is the lecturer.

The Merchant Tailors' Company have recently voted ten guineas to the Parkes Museum to aid in its work of practically teaching and demonstrating sanitary science.

The trouble in connection with alleged presence of lead in the Sheffield water-supply, which attracted considerable attention some little time since, is again making itself felt. The consumers are adopting a very rough and ready method of protecting themselves from lead poisoning. On the supposition that the lead is taken up by the water

fumes. The Governor of the district suspended the order, but the Minister of the Interior upheld the municipal order against the Governor. The fumes are admitted to be a nuisance, and expert opinion is divided as to the necessity of open-air burning.

A RECENT? dispatch from Madrid says: "The Government is gradually suppressing open air calcinations at the Rio Tinto copper mines. It was on account of these calcinations that the miners and peasants rioted recently."

FITCHBURG DEPOT AT WALTHAM.

THE station of the Fitchburg Railroad at Waltham, Mass.. illustrated in our last issue, of which Messrs. Hartwell and Richardson, Boston, are the architects, is of brick with stone trimmings finished throughout internally with hard wood, and cost something less than \$25,000.

OUR ARCHITECTURAL ILLUSTRATIONS.

A BIT OF FRENCH RUSTIC ARCHITECTURE.

ARCHWAY IN HALL, CARTER'S GROVE, JAMES RIVER, VA

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THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

A BIT OF FRENCH RUSTIC ARCHITECTURE.

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EXAMINATION OF MUNICIPAL AND SANI-TARY ENGINEERS IN ENGLAND.

THE Association of Municipal and Sanitary Engineers and Surveyors, Joseph Gordon, M. Inst. C. E., President, have undertaken the holding of voluntary pass examinations for candidates for surveyorships under municipal corporations and the local Government acts.

The examinations will be by written papers and viva vece, upon the four following subjects:

- (I) Engineering as applied to municipal work.
- (2) Building construction and materials.
- (3) Sanitary science as applied to towns and buildings.
- (4) Public health acts, and rivers pollution acts.
- Candidates will be allowed two hours to answer the questions under each of the four heads.

The total number of marks required to constitute a pass will be 50 per cent. in each of the subjects.

Further details and particulars may be obtained on application to Mr. Thomas Cole, Secretary, 6 Westminster Chambers, Victoria Street, S. W.

The following examination papers were used October, 1887, and serve as examples of questions proposed under the different sections.

ENGINEERING AS APPLIED TO MUNICIPAL WORK. E. B. Ellice-Clark, M. Inst. C. E., Examiner.

- (1) Instrumental Work.—Before commencing observations with the theodolite it is necessary to adjust (a) the telescope; (b) the horizontal limb; (c) the vertical limb. The adjustment of the telescope is to make provision for two important errors. What are they?
- (2) Surveying.—Sketch the main lines and ties you would chain in surveying the streets shown on the accompanying plan. If you consider it necessary to use a theodolite, show the manner in which you would enter the angles in your field-book. How would you indicate the levels of the surface and sewers?
- (3) Leveling.—In giving the levels for the construction of a sewer, describe the method you would adopt to ensure the invert being laid to the correct depths and gradients.
- (4) Hydraulics.—What is meant by the term "Wetted perimeter?" What causes a syphon to work? How many feet in height will an overhead syphon work in practice? What does the height of the barometer indicate in relation to the working of a syphon?
- (5) Sewerage.—Sketch* an open trench, in a wet clay subsoil, for a sewer 4 feet 6 inches by 3 feet—depth 20 feet to bottom of cutting. Show the necessary timbering. Write the distinctive names, and figure the dimensions of each piece of timber used in securing the trench.
- (6) Sketch* the egg-shaped sewer, 4 feet 6 inches by 3 feet, with diagram showing how the radii of the invert, sides and arch are determined. Give the thickness of brick-work necessary under the conditions named in Question 5.
- (7) Presuming good ballast could be obtained as an aggregate for concrete, show how you would dispose the material in constructing a concrete sewer, giving (a) dimensions; (b) proportions of cement to aggregate.
- (8) What are the advantages and disadvantages of using wholly mass concrete for such a sewer in the principal streets of a large town? (a) temporary; (b) structural.
- (9) In calculating the capacity of outfall sewers, what rainfall in twenty-four hours would you provide for in the town where you reside? State town.
- 10. Without a separate system. In making provision for the relief of sewers from storm waters—i. e., heavy falls in short periods—what information is necessary to determine the capacity of the necessary relief works?
- (11) How would you gauge the flow of a sewer, if the inclination were not known?
- (12) Paving, -- Under what conditions would you consider it necessary to abandon macadam, and pave a street with pitchers?
- (13) How would you ascertain the annual burden borne by a street, and what unit would you adopt so as to compare your calculations with those of other engineers?
- (14) Lighting.—What is meant by "average meter indication?" Give a description of it, and the appliances used to effect it successfully?

Building Construction, Etc.

W. George Laws, M. Inst, C. E., Examiner.

- (1) Name the woods chiefly used in ordinary buildings, and the qualities and uses of each.
 - *Sketches need not be made to scale.

- (2) Give the composition of good mortar. What are the most common faults of mortar used in "jerry" work, and how are they detected?
- (3) Describe "Ashlar," "Block in Course," "Snecked Rubble." Specify briefly for a wall built in one of these modes.
- (4) What is "Stoothing?" Describe its construction, and say where it is applicable, and where not.
- (5) What is the difference between "flat" and "tuck" pointing? Give a sketch of each. What is meant when joints are specified "to be drawn in with a key?"
- (6) Describe the process of "plastering" inside walls, naming each coat, and its composition.
- (7) Sketch a "Queen post" roof couple, and name the members. In what cases is it applicable?
- (8) What are the chief precautions to be taken in arranging the "exits" from a public building (say a theatre) as regards doors, passages, and stairs?
- (9) Give a sketch section of an ordinary house floor, showing the joists and flooring boards, and the ceiling of the room below, and describe how they are put together. Show how "deafening" is put in.
- (10) What are the requirements of the model by-laws as to the thickness of house walls? Give these briefly in your own words.

SANITARY SCIENCE.

Joseph Gordon, M. Inst. C. E., Examiner.

- (1.) Ventilation.—State the general features to be kept in view to secure as perfect a ventilation of town areas as possible; (a) width of streets; (b) length of streets without cross streets; (c) minimum area of open space at rear of each building, and minimum width or depth thereof between outbuildings and fence wall at the rear; (d) state what other means of ventilation than by windows and fireplaces are desirable for the interior of dwellings; also, for public halls, churches, hospitals, etc.; (e) why is it requisite that sewers and house-drains should be ventilated, and what are the usual methods resorted to in each case?
- (2) Building site and sanitary arrangements.—What precautions does sanitary science require should be taken to secure a healthy site and conditions for dwellings; (a) Suppose the subsoil to be of a doubtful character, how would you deal with the site to be built upon; (b) What position would you assign to water-closets in the interior of dwellings in order to insure proper light and ventilation and the greatest possible isolation from dwelling and sleeping apartments, and give sketch to illustrate your views as to the position of water-closets, sinks, baths, etc.?
- (3) Sewage disposal.—Give description of the chief methods of sewage disposal and treatment, and state (a) under what circumstances chemical treatment seems more practicable than an application of the sewage to land, with particulars of some of the chemical methods at present in use: (b) when and under what conditions intermittent filtration is resorted to, with some particulars of this method of sewage disposal, and quantity of land requisite per 1,000 inhabitants or per million gallons of sewage; (c) give some particulars of the application of sewage to land upon the broad irrigation system, and the area of land requisite per 1,000 inhabitants or per million gallons, according to the nature and quality of the soil and subsoil; (d)is the difficulty of disposing of the sewage at the outfall of any sewerage system at all lessened or attended with less expenditure where the earth-closet or pail system is chiefly in vogue instead of water closets; and, if so, is it at all commensurate with the increased cost of collection of the earth-closets or pails in large towns?
- (4) Sewering of towns.—In sewering a town how would you proceed to determine the maximum dry weather volume of sewage during the day to be carried off through the sewers, and what provision beyond this would you make for rainfalls per hour in determining the sizes of your sewers?
- (5) What minimum velocity is requisite for sewers to be reasonably self-cleansing, and how would you obtain this in localities where the natural levels of the districts do not admit of gradients producing such a velocity?
- (6) Why are so-called dead ends objectionable in sewerage systems, and how would you avoid them? Illustrate a case in point, and show what alterations and additions to a system of sewers are requisite to dispense with them.
- (7) Under what conditions would the separate system—that is, one set of sewers for rain-water and another for sewage—be advantageous?
- (8) Water-supply.—What are the usual precautions taken to prevent the possibility of the water-supply for

- culinary, drinking, and other domestic purposes, becoming contaminated from water-closets, etc., within a house?
- (9) House-drainage.—Describe the chief features to be kept in view in designing house-drainage under the following headings; (a) How baths should be dealt with, and under what conditions you would consider it essential to ventilate a bath waste-pipe; (b) how would you deal with the soil-pipe of a water-closet, and of what materials would you construct it; in what manner would you ventilate it, and under what conditions would you consider it essential to disconnect it or other parts of the house-drainage from the public sewers? (c) where disconnection is considered essential, in what positions would you place the disconnecting syphons, and what gradient would you consider essential on the house side of the syphon to keep it clean; and under what conditions would you consider such a syphon inadmissible? (a) where it is impracticable to drain a house without passing the drainthrough it, what materials would you use, and what other precautions would you take, to secure healthy conditions? Illustrate your views by a sketch section through house, showing drain and precautions referred to.

Public Health Acts and Rivers Pollution Acts.

H. P. Boulnois, M. Inst. C. E., Examiner.

- (1) Mention the acts which empower persons to break up the public streets for different purposes.
- (2) Under what powers can an Urban Sanitary Authority execute following works: (a) fix a bracket lamp against a wall of private property; (b) fix a street "name plate" against a wall of private property; (c) erect a urinal in a street, "not repairable by the inhabitants at large"?
- (3) What are the conditions laid down in the Public Health Act, 1875, under which existing cellars may be let or occupied as dwellings?
- (4) State the surveyor's legal duties when he finds a house within his district to be "without a sufficient watercloset, earth-closet, or privy."
- (5) How many acts and amendments thereto are there in force with regard to artisans' and laborers' dwellings and lodging-houses?
- (6) What is the maximum length of drain an owner can be compelled to construct to connect his premises with a public sewer?
- (7) What restrictions are placed upon the choice and construction of a cemetery under the Cemetery Clauses Act, and give the date of this act?

PUBLIC HEALTH REPORTS.*

THE various annual and special reports made by Mr. Simon as Medical Officer of Health of the city of London and as Medical Officer of the Privy Council, rank among the most important literature of sanitary science and preventive medicine.

The strong presentation of the evils of filth and overcrowding, which is made by their vigorous English, has given them great influence, and has made them widely quoted. As stated in the preface to the work whose title heads this notice, "this author of axioms now universally accepted may possibly be forgotten by the outside world, because his works are entombed in a mass of blue books, and in reports not very easy of access to the student of to-day."

For this reason the Sanitary Institute has caused them to be collected and edited with the aid of Mr. Simon himself, producing as a result two handsome volumes, which should be in the library of every sanitarian.

The contents of these volumes are of course very heterogeneous, treating of almost all the subjects which are of interest to a municipal health officer, and discussing the problems which come before a national health bureau. The first volume contains abstracts and extracts from the city of London reports, beginning with the first one made in 1849, and including the subjects of house-drainage, water-supply, condition of the poor, offensive trades, care of the dead, and cholera. It also contains Mr. Simon's report to the General Board of Health on the history and practice of vaccination, a report on the sanitary state of the people of England, made in 1858, and certain papers relating to the organization of medicine and pharmacy. The second volume includes the reports made to the Privy Council and the Local Government Board from 1858 to 1876, an article on contagion, and a copy of an address on experiment as a basis for preventive medicine. These papers have all in their day been eagerly read and have exerted a great influence. It is not our purpose to attempt to summarize or criticise them, but only to point out the fact that they are now collected and made easy of access to those who wish them, and the number of these in this country ought to be large.

*By John Simon. Edited for the Sanitary Institute of Gre a Britain by Edward Seaton, M. D. 2 vols., 8vo. London, 1887.



THE PRESERVATION OF BUILDING STONE.

A RECENT issue of La Semaine des Constructeurs reviews the report of Professor Tetmajer, of Zurich, who has been engaged in experimental investigation of this subject since 1884. The following abstract gives the most interesting results.

The principal injury to many building stones, especially argillaceous-calcareous stone and sedimentary sandstone s the scaling and disintegration caused by water absorbed in the pores and freezing there. This cannot be practically and satisfactorily remedied by covering the stones, nor by varnishing the surfaces, so that it has been attempted to fill the pores with some substance that will exclude moisture and strengthen the material of the stone Among the agents proposed, the "fluosilicates," invented by MM. Faure and Kessler, have given decisive results. The fluosilicates or fluates are introduced into the stone in a liquid state, and decomposing the carbonate of lime, the silicic acid formed is precipitated in a gelatinous state, liberating insoluble oxides which, with the silicic acid, fil1 the pores, while the fluorides increase the resistance and durability of the stone.

M. Tetmajer's experiments were with a fluosilicate of alumina and magnesia, Al.₂ Si.₃ Fl.₁₈. Mg. Si. Fl₆. + 6H₂ O, and a fluosilicate of magnesia and zinc, Mg. Si. Fl.₆. Zu Fl Sv₆. + 12H₂O.

The first is sold in liquid form, and the second in crystals soluble in water. They are colorless and do not affect the color of the stone. The principal experiments were made on two varieties of soft sandstone from the Ostermundigen quarries near Berne; one blue containing 18.8 per cent. of carbonate of lime, and the other yellow, containing 19.9 per cent. Fifty-two similar specimens of each kind were used.

The following results were obtained from tensile tests:

Condition of Specimen.	Resistance per square	in kilograms centimetre.	Number of tests whose mean is		
Condition of Speciment	Bluestone.	Yellowstone.	here given.		
(Anhydrous	14.6	16.0)		
Natural Dried at 1100 Saturated with	9.0	7.0	} 5 to 8		
water	3+4	3.6	! j		
Impregnated with magne-					
518	23.9	22.6	i <i>t</i>		
Impregnated with alumina	17.2	13.9	5		
Natural, frozen	11 4	13.1	10		
Impregnated with magne-					
nesia, frozen Impregnated with alum-	25 1	23.7) 5		
ina, frozen	14.4	2.5	1 1		

The anhydrous specimens were subjected to no treatment or preparation.

The saturated specimens had been immersed in water 38 days, after which those so marked were dried at a temperature of 110°.

The impregnated specimens were immersed for ten hours in the fluosilicate solution and then dried for ten days until they attained a constant weight.

Untreated or natural specimens were saturated with water and then subjected to 30 successive congealations at a temperature of 10° C., and specimens that had been impregnated with the fluosilicate were similarly treated.

M. Tetmajer concludes that this method of impregnation by magnesia is an excellent preservative for calcareous oolitic stones and for porous calcareous sandstone, but that impregnation with alumina is injurious on account of the amount of carbonic acid produced.

THE NEW STEEL CAST GUN.

THE new 6 inch steel-cast gun is being annealed after its preliminary boring to a diameter of 51/4 inches. After being annealed and hardened it will be rebored to a diameter of 53/4 inches and again turned down outside.

From present appearances the gun, when polished, will be a splendid piece of steel, and no doubt is entertained but that it will prove an eminently satisfactory piece of work. The Government will pay the manufacturers \$3,300 if the gun is accepted.

work. The Government will pay the manufacturers \$3,300 if the gun is accepted.

When finished the gun will be about 16 feet in length, and is expected to cost about \$20,000, against \$100,000, the cost of a built-up gun of the same calibre. Ordnance officers consider it the greatest success in gun-making that has been attained since the days of Dahlgren, Rodman and Parrott. It is expected to reach Washington by April 1, where it will be rifled.

ERECTION OF THE POUGHKEEPSIE BRIDGE

This double-track railroad bridge, of nearly 6,800 feet total length and 130 feet clear elevation above high water, comprises two cantilever spans of 548 feet and one of 546 feet, two connecting spans of 525 feet and two shore spans of 200 feet each, with long and lofty approach viaducts at each end. When completed it will, between Albany and New York, form the only link connecting the New England railroad system with the great Western lines, and will effect a considerable saving of time and mileage in an estimated annual traffic of 3,000,000 tons of coal, together with miscellaneous freight and passengers enough to afford a total annual revenue of \$690,000.

A charter was granted by the Legislature in 1873, and in 1875 the Poughkeepsie Bridge Co., having been organized with \$2,000,000 capital stock to build the bridge and four miles of connecting railroad, awarded the contract for the former to the American Bridge Co., of Chicago, who commenced work on piers 2 and 3, but abandoned it in 1878, leaving pier 2 twenty feet above high water, and crib of pier 3 one foot above high water and sunk forty teet through the mud bottom.

Operations were not resumed until 1886, when the Manhattan Bridge Co, secured all the property and privileges of the original company and let the contract for the completion of the entire work to the Union Bridge Co., of New York City, who commenced work in September of that year and have prosecuted it to its present advanced stage, expecting to complete and open it for traffic this year.

The superstructure is constructed by the Union Bridge Company in their shops in Buffalo, N. Y., and Athens, Pa., and the other branches of the work are done under their direction by sub-contractors. The dredging was done by the Atlantic Dredging Company, of Brooklyn, N. Y. The foundations and masonry were built by Messrs. Dawson, Symmes & Usher, of New York. The pile-driving, false-work, and erection of superstructure is done by Messrs. Ross, Sanford & Baird.

The engineering is done by The Union Bridge Company of New York, and is in charge of Mr. J. F. O'Rourke, at bridge site, where the Poughkeepsie and Manhattan Bridge Company are represented by engineers P. P. Dickinson and A. B. Paine, respectively.

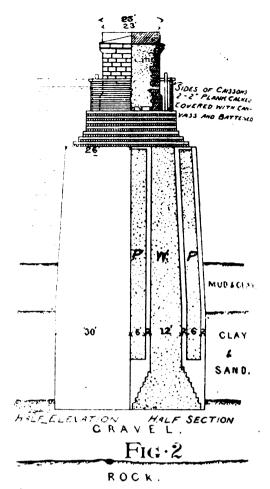
On the resumption of work in 1886 the plans, although modified, permitted the utilization of work already done on piers 2 and 3, except that the masonry of pier 2 was not of sufficient area for the steel towers and had to be rebuilt.

As shown in general profile (Fig. 1), the main spans rest on iron piers carried on a substructure (Fig. 2) which consists of a chambered timber crib resting on a stratum of gravel on a rock bed about 140 feet below high-water level, and capped with crossed grills of 12x12 square timber, carrying the masonry faced with massive coursed limestone and filled with concrete.

The cribs were built of 12x12 hemlock timber. Each course was spiked to the preceding by 425 1-inch round drift-bolts, thirty inches long, having a total estimated resistance of over 1.600 tons against any upward pull. The side, centre and end chambers (PP, Fig. 2) of the crib were closed on the bottom, forming pockets, which were weighted in the cribs at piers 4 and 5 with gravel, and at 2 and 3 with concrete, to assist the sinking. As the crib descended through the mud, clay, and sand, clam-shell dredges, working in interior chambers W removed all the underlying material and facilitated its downward progress. When the cribs had attained a support on satisfactory hard bottom the chambers W were filled with concrete, as shown in Fig. 3.

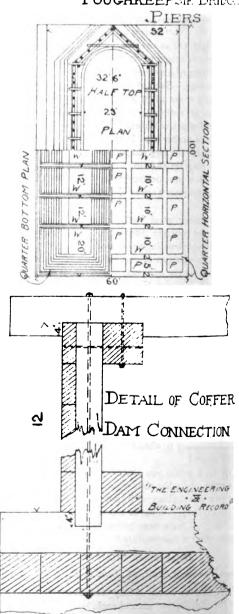
A large scow, properly moored, received gravel and cement on an elevated platform, whence it was fed into the hopper of a steam-mixer, which delivered the concrete to a pair of buckets alternately presented, which descended and were emptied by means of a latch and hand line. The loaded bucket descended to the bottom, dumped its contents and was returned to place before the other was filled, so that the mixing and filling went on uninterruptedly. When the chambers were filled the concrete was leveled off by divers and the grillage laid on top.

The caissons were then brought to approximate position over the grillage, and the masonry commenced inside on their bottoms, which were from 6 to 14 feet thick, of solid 12x12 hemlock. The caissons were sunk until nearly in contact with the cribs, when they were carefully placed in exact position, and there fixed by building on sufficient additional weight at high tide.



Coffer Dam and Crib

Poughkeepsie Bridge



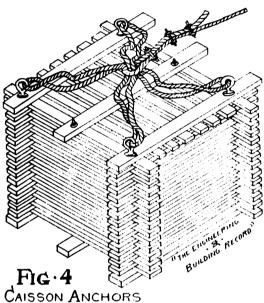


After the top of the masonry rose above high water, the sides of each caisson, which were bolted down to its bottom, were ready for removal.

Much difficulty was experienced in handling the great cribs, whose weight and inertia were enormous, and whose least surface exposed so great an area to the pressure of the stream.

After being built near the shore they were towed out by steam-tugs in the interval between tides, and anchored by boxes (Fig. 4) 6x6x6 feet inside, made of 3x10 planks 9 feet long, bolted through the corners and middle, floored top and bottom, and filled with stone. They weighed about 10,000 pounds each in water, and were attached by steel wire ropes 1 and 1½ inches diameter about, 600 feet long, to the corners of the cribs.

The great difficulty lay in adjusting the anchor ropes so that all were alike strained at once and worked efficiently with the changing tides. When once this was accomplished it was comparatively easy to draw the crib up to its exact position. The strain was very liable to come on one anchor only, which would be immediately started from its bed and all the rest dragged in succession.



Poughkeepsie Bridge



Cribs 2 and 3 got away several times. Crib 2 was once carried three miles up the river, and brought back by two steamers with great difficulty. Neither 2 nor 3 were sunk in exactly the right position, but they were close enough to be well within the limits of adjustment of the caissons.

Crib No. 4, drawing fifty-two feet of water, encountered a heavy freshet, which, with the ebb tide, added to the normal 2½-mile current of the river, carried the crib, six anchors, and three steamers several miles. It was stopped and returned on a flood-tide, but a similar experience was repeated three times before it was finally safely sunk.

Pier 5 was provided with eight anchors up stream, six down stream, and four on each side, and, profiting by past experience and the subsidence of the freshet, it was sunk without trouble.

For the above data and description, and the drawings from which our illustrations have been prepared, as well as for many other courtesies, we are indebted to Mr. Robert Baird and to Mr. O'Rourke, engineer in charge for the Union Bridge Company.

RINGS AS EVIDENCE OF AGE IN TREES.

AN agent of the U.S. Forestry Department, Mr. R. W. Furras, who has given much study to rings in timber as indicating the age of trees, has reached the following interesting conclusion:

"Concentric or annual rings, which were once accepted as good legal evidence, fail, except where climate, soil, temperature, humidity, and all other surroundings are regular and well balanced. Otherwise they are mere guess-work. The only region, within my knowledge, where either rings or measurements were reliable indications are in the secluded, even, and regularly tempered valleys of the Southern Pacific coast. Annual measurements of white elm, catalpa, soft maple, sycamore, pig hickory, cotton-wood, chestnut, box elder, honey locust, coffee tree, burr and white oak, black walnut, osage orange, white pine, red cedar, mulberry and yellow willow (nineteen species), made in south-eastern Nebraska, show that an 'annual growth is very irregular, sometimes scarcely perceptible, and again quite large,' and this he attributes to the difference in seasons. As trees increase in age inner rings decrease in size, sometimes almost disappearing. Diminished rate in growth after a certain age is a rule. Of four great beeches mentioned in London, there were three, each about 17 feet in girth, whose ages were respectively 60, 102, and 200. Mr. Furras found twelve rings in a black locust six years old, twenty-one rings in a shell-bark hickory of twelve years, ten rings in a pig hickory of six years, eleven rings in a wild crabapple of five years, and only twenty rings in a chestnut oak of twenty-four years. An American chestnut of only tour years had nine rings, while a peach of eight years had only five rings."

THE BERLIN METROPOLITAN RAILWAY.

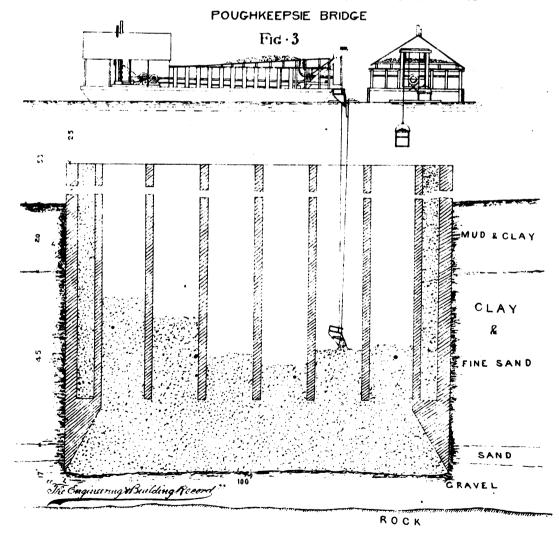
WITH the nine illustrations on pages 214 and 215, we conclude our description of the Berlin Metropolitan Railway.

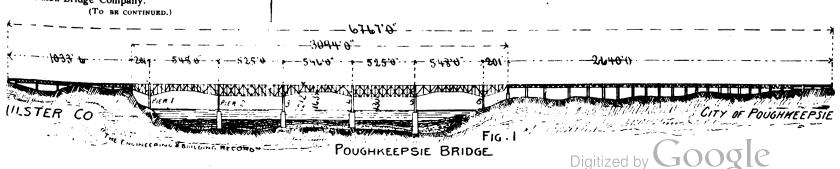
Our readers will remember that the pendulum columns used under the Koenigstrasse crossing were illustrated in our last issue. We cannot doubt that they have shared the interest we have felt in reproducing this most important and instructive work, especially interesting to those residing in New York City, where so much has been already done in the way of rapid transit and where so much more remains to be done and is indeed now being actively discussed. The Berlin Railway in its general features embodies in many respects our idea of what would best answer the requirements of rapid transit in New York City, and we commend it to the careful study of those upon whom the solution of that problem depends.

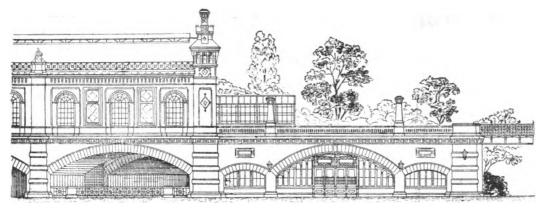
SLEEVE-JOINTS FOR LARGE WATER-PIPE.

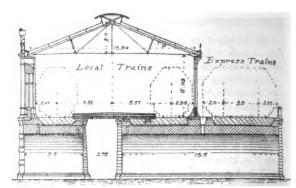
Of the Thirlmere extension of the Manchester Corporation Water-Works fifty thousand tons of pipes have been ordered for the first main. Mr. G. H. Hill, the engineer, has taken a somewhat new departure in making a large proportion of the pipes plain-ended, or plain tubes 12 feet long, the tubes being connected, and the joints made with collars. The joints are also exceptional, yarn being dispensed with and the total weight of piping and the cost of jointing thereby materially reduced. The first main which is now to be laid will deliver 10,000,000 gallons per day. The pipes in the lake district are 48 inches in diameter, those in the middle of the line 40 inches in diameter, and those near the Manchester end 36 inches in diameter.—Engineer.

METHOD OF MIXING & LOWERING CONCRETE INTO CRIBS



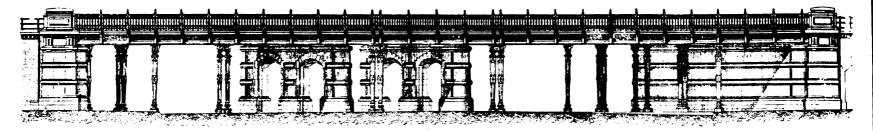




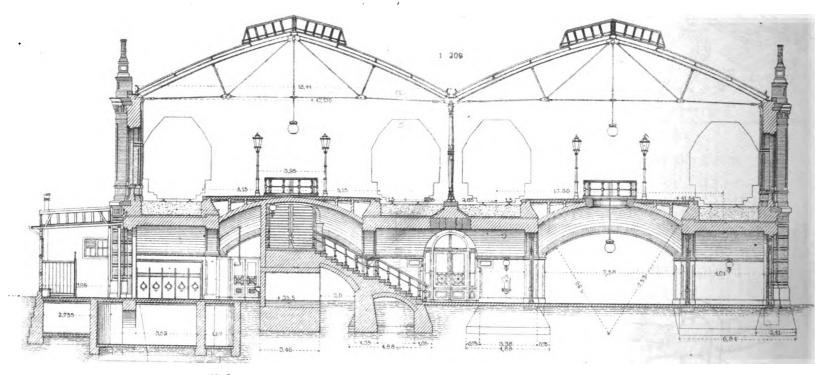


PARTIAL ELEVATION OF THIERGARTEN STATION.

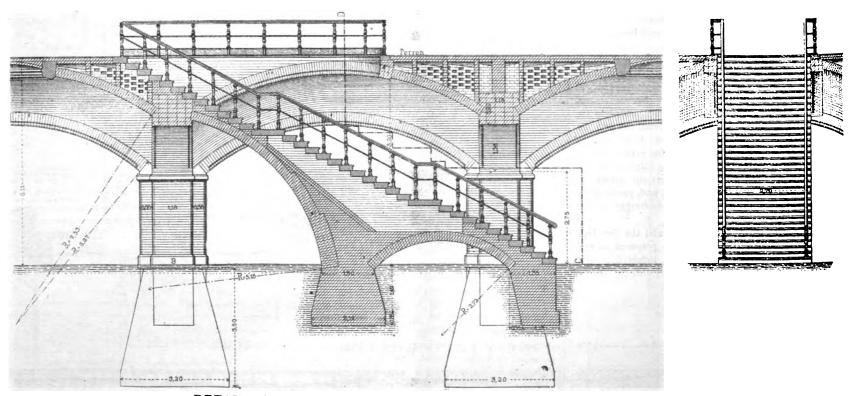
CROSS SECTION OF THIERGARTEN STATION



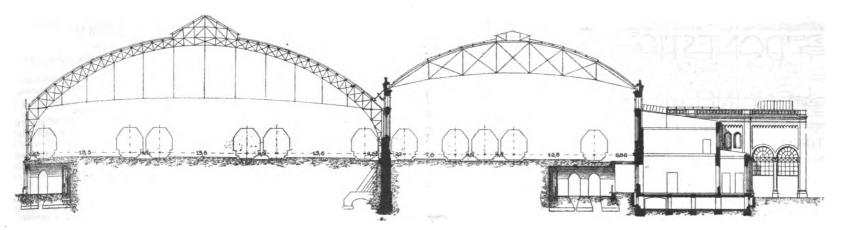
ALT-MOABIT STREET CROSSING.



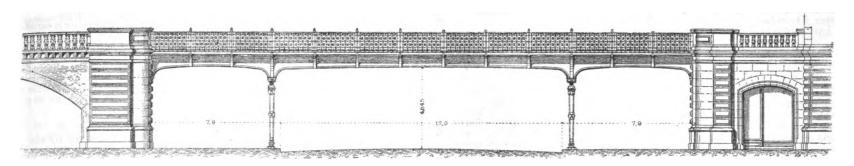
CROSS SECTION OF ZOOLOGICAL GARDEN STATION.



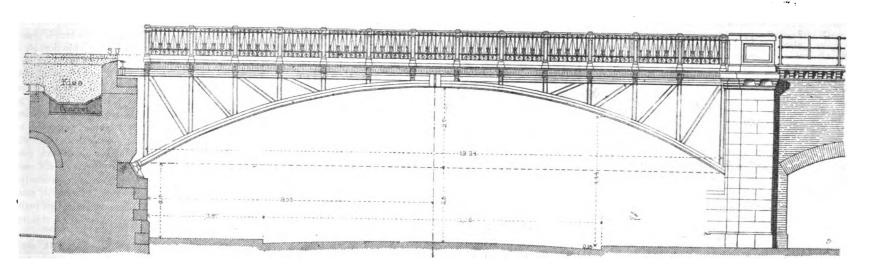
DETAIL OF CONSTRUCTION, ZOOLOGICAL GARDEN STATION.



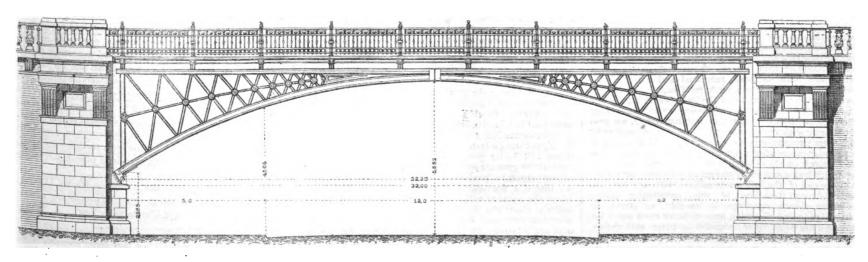
CROSS SECTION OF SCHLESISCHER DEPOT.



KOENIGSTRASSE CROSSING.



KLEINE PRASIDENTENSTRASSE CROSSING.



STALLSTRASSE CROSSING.



HEATING AND VENTILATING WORKSHOPS.*

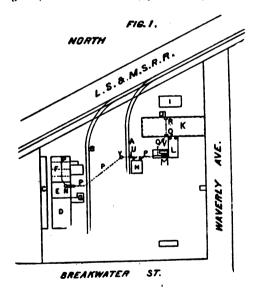
WHILE extending the works of the Walker Manufacturing Co., at Cleveland, O., in the fall of 1886, the subject of heating the shops received considerable attention, mainly on account of the shops being somewhat scattered. We desired to establish some system that would be adapted to extensive shops, and at the same time be economical. After looking over the various methods of steam-heating, and that of heating by hot air, we decided to try the latter. It occurred to us that hot air had been successfully used in drying almost all conceivable kind of articles, and espeing almost all conceivable kind of articles, and espedrying almost all conceivable kind of articles, and especially lumber, so that its adoption to heat workshops by discharging hot air into same could scarcely prove unsuccessful. The peculiarity, however, of the location of our shops, their distance apart being considerable, presented

shops, their distance apart being considerable, presented difficulties for conducting the heated air from one shop to the other. In order that you may better understand same, I have provided a plan of our works (see Fig. 1).

The entire enclosure being about seven acres, and bounded on the east by Waverly Avenue, on the south by Breakwater Street, 520 feet to the lot line; on the west by the lot line, and on the north by the L. S. & M. S. Rail-

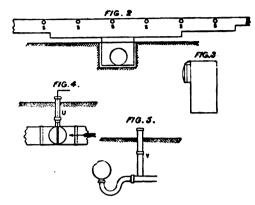
way.

The railroad switches are represented by A and B; the original part of works is shown on the west side, C being machine-shop two stories in height, original part of works is shown on the west side, C being warehouse, D being machine-shop two stories in height, E being blacksmith-shop, F being No. I foundry, G engine and boiler-room No. I; the north-east portion is the new part of works, H being the office, I machine-shop, J pattern vault, K toundry, L melting-house for foundry, M engine and boiler-room No. 2; the distance from engine and boiler-room M to receiver of hot air N at the original part of works is as a feet; in boiler-room No. 2 we pleased and boiler-room M to receiver of hot air N at the original part of works is 355 feet; in boiler-room No. 2 we placed a 6x9 Sturtevant blower, perpendicular diameter of housing being 120 inches, the outlet 42x42 inches square, driven at a speed of from 50 to 275 revolutions, according to our requirements. Immediately in front of the outlet of blower we placed our vault for steam-pipes, which contains several thousand feet of 1-inch piping built in the form of a radiator, and in addition to these about one thousand feet of 2-inch piping, all supplied by a 4-inch steam-pipe from the boiler; also 5 inch steam-pipe from engine exhaust. The only reason for using two systems of heating pipes was on account of our peculiar location, not having room enough to place sufficient 1-inch pipes vertically. We found



that we required not less than ten square feet of pipe-surface per one thousand cubic feet of space in buildings. The conduit receiving the hot air radiating from these pipes at a temperature of from 100 to 180 degrees, is about four feet square, built of brick, cemented and covered with 4-inch flags; from this conduit or receiver, we laid 24-inch sewer-pipes in the direction of the lines O and P; the line O passing into foundry K, a building 200x58 feet; after entering the shop underground into receiver Q, we pass across same with 18-inch sewer-pipes to second receiver R; from these two receivers we connect galvanized piping of rectangular shape above ground (see Fig. 2), starting at the receivers with a section of 24x10-inch pipe, and that we required not less than ten square feet of pipe-surthe receivers with a section of 24x10-inch pipe, and diminishing at about every 20 feet to a smaller section un til at the end of the line we terminate with an 8x8-inch pipe. Along the line of this rectangular piping we place 6-inch openings in its side, as shown at S (see Figs. 2 and 3), which have a loose cover much the same as a milk-can cover, secured in place with chains, and can be placed over the openings or left off at will, so

that any desired part of the shop may be warmed. that any desired part of the shop may be warmed. In passing under doors or openings in the buildings, we invaribly used sewer-pipe under ground, and connected same to the galvanized piping after passing said doors; the line P passes under No. 2 engine foundation, through into the yard as shown, in the rear of office, where at points T T we take off two 10-inch branches at right angles, to heat the office, which is a building 40 feet angles, to heat the omce, which is a building 40 leet square, two stories in height; we carry the sewer-pipes into the building, and then connect rectangular galvan-ized pipes immediately under the floor between the joists, and open same on the first floor with four 9x12-inch ordi-nary registers, and then pass vertically against the wall with 12x6-inch galvanized piping to the second floor,



with a similar pipe again under the floor and between the joists, which opens on the second floor with four 8x12-inch ordinary registers.

ordinary registers.

At the point U in the 24-inch sewer-pipe we placed a valve, as shown in Fig. 4, so that we could regulate the amount of hot air delivered to the original portion of our works, and retain as much as we needed for the new portion of works and office; this valve is operated from the surface outside, the stem of valve passing up through a 6-inch sewer-pipe, which has a cover on its upper end for 1-inch rod to work in; after leaving the point U the 24-inch sewer-pipe passes under the railroad switch A, across the yard on an angle as shown, and underneath railroad switch B into receiver N, then through the shops, underground as before, to suitable points for outlets. underground as before, to suitable points for outlets, which are provided with similar arrangements, as shown

in Figs. 2 and 3.

The locations V being the lowest in the line of piping. The locations V being the lowest in the line of piping, we deemed it necessary to provide an arrangement for draining off the water should any find its way into the 24-inch main. Fig. 5 is an illustration showing the way this was accomplished; we coupled to the bottom of main an ordinary bend, as shown, so that the water accumulating in the main would pass off through the 6-inch trap and pipe, as shown. We provided a vertical pipe coming above ground with a cover on same, so that we could look down into the 6-inch drain at any time and see if any water was passing: the exposure of a 6 inch surface of water in the passing: the exposure of a 6 inch surface of water in the main peoved to be of no serious objection; in rainy or thawing weather the 6-inch drain would show a small amount of water passing continually, but in frosty weather same would cease.

weather same would cease.

From the description given, you will notice that the entire line of mains are underground, which was quite a questionable undertaking, as the amount of absorption of heat by the earth was likely to interfere with its successful working. After being completed, and having started the blower, we found this to be the case for several days, but after running the blower four days and nights we then got heated air at the receiver N, which showed that the earth surrounding the pipe had been absorbing the heat; on the fifth day, after running the blower continually. earth surrounding the pipe had been absorbing the heat; on the fifth day, after running the blower continually, we found that the snow melted on the ground, locating the line of pipes throughout the yard. After this we continued to run without any perceptible loss from radiation; the ground had, no doubt, been dried out for a diameter equal to eight feet. We continued the use of the plant for the entire winter with excellent success, but we found that at the receiver N, and at the various openings in the original shops that we had not sufficient heat for the coldest of weather, and at once put in a series of pipes about twenty feet in advance of the receiver N, so as to reheat the air on its passage to shops; same was supplied with steam from boiler No. I, and proved entirely satisfactory. In operating the manifold pipes in vaults it is necessary to let the steam enter so that it will pass to the greatest number of pipes, always allowing the water from condensation to pass by gravitaallowing the water from condensation to pass by gravita-tion to a trap. In this arrangement we provided a tank some four feet in diameter and nine feet deep underground in boiler-house No. 2 to receive the condensed water from the pipes through trap. By this means we were enabled to use full boiler pressure on the manitold pipes, which gave us the greatest amount of heat, and could change to exhaust steam in moderate weather. In the same tank we placed a float-valve from the city water-works, and mixed the water at will. The water was returned to the boiler at about 180 degrees temperature, thus saving considerable water and heat with same by using the water over again instead of blowing same through the steampipes, as is usual in steam heating in buildings.

It will be seen that no steam-pipes leave the boiler-room, hence they are all protected against frost and leakage, the water being trapped out as fast as it accumulates.

I'he advantages of this system are:

First.—It is economical in use.

Second.—It is economical in repairs.

Third.—There is no danger of bursting pipes and flood.

Third.—I here is no danger of bursting pipes and flooding the shops with water.

Fourth.—Cleanliness; the engineer firing his boiler ausual, and wheeling out his ashes, and to all appearance there is nothing more going on than would ordinarily be expected about an engine and boiler-room.

Fifth.—The displacement and circulation of air in the workshop by foreign the ways making. This is a satisfact.

workshops by forcing the warm air in. This is particularly advantageous in our foundries, where the introduction of This is particularly heated air carries away the smoke incident to to the various operations of a foundry. It will also be seen that when the heated air is introduced the cold air must be dis-

placed, passing out at whatever place it can.

Sixth.—The galvanized pipes of themselves are warm with the heated air, and serve as an excellent means for keeping cores dry for molders' use; and whenever a molder wishes to dry off his patterns he can do so without injury, let them be ever so delicate, by placing them near the galvanized pipes.

Seventh.—In summer time the entire system is applicable to cooling and ventilating the works without the slightest change, same as the man who cooled his dinner and warmed his hands with the same breath, nothing further

steam can pass through into the manifold pipes.

It would be safe to say that the temperature in our office during the hot days of the past summer was lowered from five to ten degrees, and the circulation of air was perfect by this means

So far as we are aware, this is the first time that bot air has been attempted to be carried a long distance under ground, and we consider the success of this case quite an important demonstration, where similar systems may be needed or useful.

CONTAMINATION OF WATER BY LEAD.

THERE has been quite a lead-poisoning scare in Shelfield, Eng., which has called out the usual number of theories and suggestions. Among others Dr. Sinclair White has proposed a simple remedy—namely, filtration through lime-which seems likely to be adopted.

The Journal of Gas-Lighting directs attention to aletter recently addressed to the Sheffield Telegraph by Mr. Alfred H. Allen, F. I. C., F. C. S., President of the Society of Public Analysts, in which some suggestive remarks are made. The proportion of lead which is generally considered to render water seriously objectionable is one-twentieth of a grain per gallon; but Mr. Allen says there is some reason to believe that in cases in which serious effects have been observed in Sheffield, the proportion has considerably exceeded this limit. It must not be supposed, however, that there is any danger in drinking a glass of water containing such a minute proportion of lead. It is not the single dose or a dozen doses which will produce any ill effects, but the constant use of such contaminated water. Lead is a cumulative poison, and each successive dose becomes stored up in certain organs of the body until the poisonous effects ensue. Further, it must not be supposed that every one is equally susceptible to the effects of lead, there being a great difference in this respect.

Mr. Allen adduces a striking instance, which came within his own experience, of the way in which lead poisoning may occur. A year or two since a member of his family suffered from symptoms which her medical adviser considered to be due to lead-poisonieg. The water drawn from the tap the first thing in the morning contained half a grain of lead per gallon, and about half this proportion after being allowed to run. By passing the water through a particular description of carbon filter every trace of lead was removed; but tea made from such pure water was sometimes found to contain 0.75 grain of lead per gallon. Analysis showed that the tea as bought was free from lead, and for some time Mr. Allen puzzled to account for its presence. It was afterwards found that the fur, or deposit, inside the kettle contained a considerable proportion of lead, some of which became dissolved in the water boiled in it. The kettle being replaced by a new one, the symptoms of lead-poisoning disappeared under proper treatment. He attributed the lead in the deposit to a servant having habitually filled the kettle from the hot-water tap, for hot water, it appears, acts on a lead pipe much more vigorously than cold.

It is reported by the Medical Officer of Health (Dr. A. Mackintosh) that from 100 to 150 more people are suffering from lead poisoning in Chesterfield, Eng.

La Genie Civil is publishing a very comprehensive illustrated description in serial form of the drainage of Boston, by a Quebec engineer, M. C. E. Gauvin.



^{*}Paper read by John Walker before the Civil Engineers' Club of Cleveland, and published in the Journal of the Association of Engineering Societies.

THE PROPOSED NATIONAL BUREAU OF HARBORS AND WATERWAYS.

NEW YORK, February 28, 1888.

SIR: The bill introduced into the United States Senate by Senator Cullom appears to me to be a step in the right direction, but to be faulty in several respects. There is no good reason that I can see for placing the public works of the country in the hands of the War Department. It would be better to establish a Bureau of Public Works in the Department of the Interior, or better yet to create a Department of Public Works, the head of which should be a Cabinet officer, and control all the surveys, designs, and constructions which come under the jurisdiction of the general Government. The coast, geodetic and geological surveys, the improvement of harbors and waterways, the construction of highways which may be needed for easy transportation of troops to quell insurrection or repel invasion, the design and construction of public buildings and probably other scientific works, should be placed under one head and so organized that the best talent and experience available can be applied to the work.

If this cannot be done now, or is not considered expedient by those having the matter in charge, the present bill may perhaps be accepted as an improvement in some respects on past practice, inasmuch as it makes it possible for civil engineers who have not been educated at the expense of the Government to attain positions commensurate with their abilities and attainments from which they are debarred by the existing system.

But the scope of the bill is too narrow and there are two noticeable provisions in it which make it look as if the proposed "Bureau of Harbors and Waterways" was to be used as an asylum for aged and infirm incapables. Pirst and second assistant engineers may be appointed from civil life without limit as to age, and at sixty-five years of age shall be retired on half pay for life. It will be a very easy matter for members of Congress to get a good many old engineers settled on the pay-rolls at \$900 to \$1,350 per annum for life under this provision.

There does not appear, moreover, to be any provision for getting rid of incompetent men who have once gotten into the corps. Again, officers of the Engineer Corps of the Army cannot be assigned to duty in this new corps after its first organization. Two-thirds of vacancies are to be filled by promotion of existing members of the corps, and the other third by new men from outside, but not from the army. The Government ought to be permitted to avail itself of the services of the men it has educated.

The express provision that the Secretary of War can call on experts outside of the corps only when Congress has made a special appropriation for the purpose is most unwise, and will lead to an immense lobby business by adventurers who have patent schemes of improvements, and will prevent honest experts from being consulted.

Taken altogether, the bill appears to have been drawn to enable a few of the former Mississippi River engineers to get good positions, and civil engineers in general cannot be expected to take much interest in procuring its passage.

J. J. R. Croes.

NEW YORK, February 29, 1888.

SIR: To express my views on the pending Cullom bill, looking to the creation of a Bureau of Harbors and Waterways, I send you the following notes.

The evils of the present system of conducting the work of river and harbor improvements under the auspices of the War Department are, as I understand them to be, substantially as follows:

First. — Irregular appropriations, some years there being none at all.

Second.—The uncertainty, mainly on this account, of continuing and completing improvements, which entails considerable expense to preserve unfinished work from natural destruction.

Third.—The promotion of army officers by seniority, which makes it sometimes possible to have the less competent man occupy a position of greater responsibility.

Fourth.—The difficulty for one person to master at the present time the varied knowledge and practical experience necessary to excel in all the branches of engineering which now fall under the direction of the War Department; modern military engineering being a branch which alone occupies the entire time of the respective officers in the most important European countries; harbor and river engineering likewise being a branch in which alone prob-

ably no one can in future distinguish himself without devoting all his time and energy exclusively to the same. Therefore some branch must necessarily suffer under present conditions.

Fifth.—The fact that able and experienced civilians engaged as assistants by the U. S. Engineers are sometimes required to report to young and inexperienced officers and to submit to their direction.

Sixth.--The impossibility of promotion among civilians to the higher positions of responsibility equal to those held by the army officers, and their liability to be discharged at any time on account of the failure of an appropriation bill.

I think that among most of the army officers the existence of the above evils will be acknowledged and that they would be glad to see a remedy suggested.

The proposed bill intends to separate the essentially military branches of engineering from those pertaining to the improvements of waterways and harbors. It would enable both of them to receive more attention through a greater concentration of duties, and in this way could not fail to be a great advantage.

The bill further proposes to engage the most meritorious applicants for the new corps up to the rank of, but not including, division engineer, where the duties begin to be mostly administrative and of necessity require a considerable knowledge of the routine work, which can be gained only through experience in the bureau itself. In this point, too, the bill would accomplish an improvement, because the material for eventually filling the higher positions would not be confined to the graduates of one, but extended to those of all engineering schools.

Furthermore, the establishment of a separate bureau with a permanent force would require the appropriations to be made with some regularity, and thus remedy what is probably the greatest defect of the present system.

Yet, withal, I believe the bill as now before Congress has serious defects, which might possibly equal in degree those which now exist.

In the first place, promotion by seniority, which is incorporated in the bill for every position above that of assistant, cannot but expose the bureau to some of the same evils which are now complained of. Even among the assistants, promotion will go by seniority, if the Examining Board finds the oldest member just good enough to pass, and a really better man may remain behind. In all Government work, which is fully as important as private work, if not more so, merit and special fitness for the higher position should alone decide.

This excellence is not attained simply with age. It is attained by peculiar opportunities during early life, by hard individual work and innate capabilities. The channels of knowledge and of experience are spreading over such large territory that nothing but carefully regulated and steady work enables an engineer to follow the few channels which he has selected for himself. And who will to-day doubt the great influence of heredity in helping us to success? Some men have naturally a bent in this or in that direction. If they follow it they encounter less resistance and reach a further point than those who lack the innate ability. This is particularly true when comparing the executive faculty with that for purely scientific work. An engineer may be an excellent scientist but a poor executive officer, and no amount of training will change the relation. The positions upwards from the grade of Division Engineer should be filled by those who are thorough gentlemen, and who will make the best executive officers, whether they are the oldest or not, because their main duties will be of this nature. We take this view generally in private business. Why should we not take it also in public business?

The promotion by seniority takes away the natural incentive to progress which is due to a fair competition. It causes relative stagnation, such as we sometimes find in the older countries, instead of constantly inducing individuals to do better work.

I think another objectionable feature of the bill is the large number of new positions created by it. According to Major Ernst's statement the number of persons engaged at present is 171, the number of those provided fot in the bill is 614, or if the cadets are excluded, 364. It does not seem wise nor even necessary to establish so many new and permanent positions without considerable previous training. It would produce a very heterogeneous body, and might takes years for proper adjustments. Ambitious, but less competent and less honorable persons

than the service should have would, under such conditions, contrive to get an early foot-hold and possibly devote most of their time and energy mainly to acquire a position which they do not deserve, and who would eventually cast discredit upon the service.

It is, of course, easier to criticise than to do better yourself—easier to tear down than to build up. So in this case I do not feel able to offer a better substitute for the bill. The following stray thoughts, however, have passed through my mind, and I will put them down for what they are worth. I trust that out of all these discussions some one with a synthetic turn of mind may find the right solution.

While I believe that a department of public works with a Cabinet officer would ultimately give us the best results, both in quality of work and economy, yet I also believe that at the present time such a change could not be accompliched. Therefore a bureau, as a branch of the War Department, now seems the only solution. The Corps of Engineers so far have had charge of all the work. We cannot accuse them of incompetency, but must acknowledge from the results that they have generally succeeded well, the exceptions being due to causes which could be remedied from within. Why not therefore have the proposed bureau manned substantially with the same officers who have now charge of the works, but giving them promotions and new titles somewhat as suggested in the bill? A sudden large increase over the present force does not seem warranted, because the appropriation for public works will probably not be increased in the same proportion. And, further, to obviate the objections to the present system, mentioned at the beginning, is it not feasible to establish a system of promotion in such a bureau altogether on grounds of merit and fitness instead of seniority? Is it not practicable, as suggested in the bill, to open the doors of such a bureau to all engineers, not the graduates of West Point only. who may desire and are competent to enter in the lower ranks and follow in the line of regular promotion with the rest? The present army officers having had more experience, will at first naturally be at the head, and as they are pensioned make room for those following them in merit. Every officer of the bureau should be employed for life and have the assurance of a pension in accordance with his rank when reaching old age.

My impression is that these questions could all be answered in the affirmative, and that the present evils could in that way be most readily overcome. It would but slightly change the personnel and greatly improve the system.

RUDOLPH HERING.

SEA-COAST DEFENSES.

UNDER this heading an extract from the annual report of the Chief of Engineers of the U. S. A. has been published. It opens with a regret that lack of funds has paralyzed all action during the past year. The list of appropriations estimated as required this year amounts to \$5,234,000, of which \$2,840,000 is for construction of gun and mortar batteries at the chief seaports, and \$30,000 for torpedo experiments and practical instruction of engineer troops detailed for the service. The report states that a large amount of practical work can be done in the way of defence and putting present earth-protected batteries in an efficient state without waiting for a decision on the question of the character of armor to be used in land defences.

In the appendix is a report by Major W. R. King, now in charge of torpedo experiments at Willett's Point, and of the "Post and Engineer School of Application" there. During the year six engineer officers completed the three years' course, and three artillery officers the seven months'

The recommendation is made that since all officers coming from West Point have already had a four years' course of study from text books, the course at Willett's Point be made practical, wherever text-books can be replaced by observation and experiment. For example, the weight and dimensions of a torpedo case, an anchor, etc., etc., might be obtained and recorded by each officer for himself, just as he would obtain corresponding data if traveling in a foreign country. In the same manner let them use the testing-machine for ascertaining the strength of rope and building materials.

An account is given of the test of three Sims' fish torpedoes steered and propelled by electricity. They obtained speeds of 8.67 to 10.17 miles per hour; but the experiments were not entirely satisfactory in all respects.

A number of other practical suggestions are made, and in two other appendices the courses of instruction for winter and summer are given.

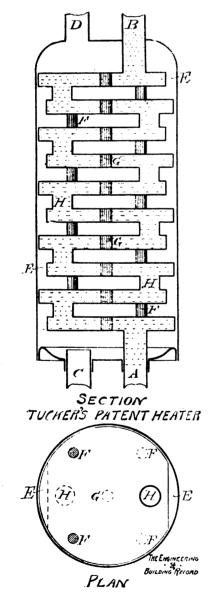


Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

A HIGH-LOW PRESSURE WATER-HEATER.

THIS device is intended for use in cases where there are two systems of water-supply of different pressures in the same building and it is desired to draw hot water from both systems without the complication of two waterbacks or a double boiler. It is simply an arrangement for heating the water of one system by that of the other by bringing the two systems together in one vessel with a large surface of thin metal between them to facilitate the transmission of heat. As here shown, the high-pressure supply, having been heated in a water-back in the usual way, enters the apparatus at A, and, passing through various disk-shaped chambers connected by passages H H, emerges at B. The low-pressure supply which it is desired to heat enters at C, and rising around the heated chambers, its passage being facilitated by their being cut away on alternate sides, as shown at E E, is finally warmed and discharged at D.



The braces G G and F F are to keep the chambers in position and to resist the distorting effects of the difference of pressure. The apparatus is 8½ inches in diameter and 13 inches high, and is made of heavy copper, so arranged that by removing the bottom the chambers can be taken out. The height of the chambers is three quarters of an inch, and the distance between them is the same.

This heater is used in the residence of Max Nathan, Esq., and is referred to in the description of its plumbing, which was concluded in our last issue. It is the invention of Mr. John Tucker, of the firm of Byrne & Tucker, plumbers, New York City.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Can-Light Company Manhattan Company Martropolitan Company Muttal Company Muttal Company Municipal Company Municipal Company Municipal Company Cas-Light Company Cas-Light Company	Equitable Gas Light Company.
February 25	24.57 19.34 19.78 30.47 27 92 22.9	6 29 55

ELECTRIC LIGHT FROM AN ARTESIAN WELL.

An electric-light plant is about to be put in at Yankton, Dak., to supply 500 incandescent and twenty-five heavy arc lights, requiring about forty horse-power. The power is expected to be supplied by an artesian well now flowing, and if the experiment is successful another well will be bored and the capacity of the light plant doubled.

A NEW INSULATING MATERIAL.

A VERY valuable insulating material, decribed in the Chronique Industrielle, has just been produced, that is composed of one part Greek pitch and two parts burnt plaster, by weight, the latter being pure gypsum, raised to a high temperature and plunged in water. This mixture when hot is a homogeneous, viscous paste and can be applied by a brush or cast in molds; it is amber-colored and possesses the insulating properties of ebonite, and can be turned and polished. Its advantage is its endurance of great heat and moisture without injuring its insulating properties.

DETECTING GAS LEAKAGE.

To DETECT the leakage of gas, Dr. Bunte in the Canadian Magazine of Science, suggests the use of paper dipped in palladium chloride solution. Such paper changes its color in the presence of gas coming from leaks imperceptible by the odor, and which produce no effect upon the earth covering the pipes. Dr. Bunte suggests the following method of practically applying the test to street-mains: Above the pipes are excavated, at intervals of two to three yards, holes twelve to sixteen inches deep, corresponding to the joints and sleeves. In each opening is placed an iron tube, half an inch in diameter, within which is a glass tube containing a roll of the test paper. The air from about the main enters the iron tube, and the trace of gas which may be present reveals itself by coloring the paper brown or black, according to its quantity. If, after 10 or 20 minutes, the paper is still white, it may be certainly concluded that at the point tested there is not the smallest escape of gas. Various authorities who have experimented with Bunte's method certify to its efficacy

A THEORY OF THE ORIGIN OF PETROLEUM.

Annales Industrielles reports that Prof. Mendelejef has recently advanced the idea that petroleum is of purely mineral origin, and that the formation of it is going on every day. He has, moreover, succeeded in producing artificial petroleum by a reaction that he describes, and he states that it is impossible to detect any difference between the natural product and the manufactured article. His theory is as follows: Infiltrations of water, reaching a certain depth, come into contact with incandescent masses of carburets of metals, chiefly of iron, and are at once decomposed into oxygen and hydrogen. The oxygen unites. with the iron, while the hydrogen seizes on the carbon and rises to an upper level, where the vapors are condensed in part into mineral oil, and the rest remains in a state of natural gas. The petroleum strata are generally met with in the vicinity of mountains, and it may be granted that geological upheavals have dislocated the ground in such a way as to permit of the admission of water to great depths. If the centre of the earth contains great masses of metallic carburets, we may, in case this theory is verified, count upon an almost inexhaustible source of fuel for the day when our coal deposits shall fail us. - American Gas-Light Journal,

THE PARKES MUSEUM, 74a MARGARET STREET, REGENT STREET, LONDON, W., February I, 1888. SIR: H. R. H. the Duchess of Albany has graciously consented to become patroness of Parkes Museum, of which H. R. H. the Duke of Albany was president until his decease. E. White Wallis, Secretary.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

WHAT IS SANITARY ENGINEERING—WHERE IS IT TAUGHT?

TUBBSVILLE, HENRY Co., O., February 14, 1888.

SIR: Will you please give me some information in regard to learning sanitary engineering, and oblige,

ALFRED S. TUBBS.

[We are not quite certain as to what is meant by "sanitary engineering" in this question.

What we mean by this term includes all branches of engineering which are connected with municipal sanitary work or with the sanitation of buildings—in other words water-supply, sewerage, house-drainage, heating and ventilation, etc.

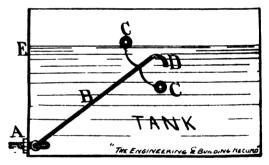
We do not consider that the knowledge required by an inspector of plumbing is that which a sanitary engineer should possess, and no one should claim to be, or should be considered a sanitary engineer who cannot make the surveys and prepare the drawings and specifications for a system of water-supply or of sewerage for a city of 50,000 inhabitants.

This is to be learned in the technological schools which have been formed in this country for training engineers. The School of Mines of Columbia College has formulated a special course in sanitary engineering, the schedule for which it will no doubt forward on application. This is for a four years' course of study, the first two years including the same studies as the ordinary engineering course.]

SURFACE SUCTION.

NEW HAVEN, CONN., February 11, 1888.

SIR: Seeing your plan for drawing water from the water-line of a tank or cistern by a hose, which in time, if constantly immersed, will rot, I will make public a better plan applicable for either a cistern or tank.



C C are two copper balls which in a large tank should be about six inches diameter, and weighted so as to keep the supply two or three inches below the surface of the water. A is a hollow core cock with threaded shank passing through end E of tank and receiving outside a coupling and a lock nut. When B is turned up against E it shuts stop-cock A. B is house supply-pipe, that will also serve to fill the tank with, and should then have the bend D to prevent the water from being thrown over the side of the tank, and a check-valve just above the pump-valve to prevent back-pressure.

Thomas A. Jarrett.

OVERHEAD STEAM-HEATING.

DETROIT, February 18, 1888.

SIR: Will you kindly inform us in your next issue if there is a patent on the overhead system of steam-heating?

M. B. & Co.

[There is no patent on simply taking the steam-main to the top of a building and feeding downwards if you have separate steam and return connections on each radiator.

The "Mills Patent System," that many seem to think covers all methods of steam-supply from overhead mains, really includes only the use of a descending main, answering at the same time both for steam-supply and for return water, to which the radiators are connected by a single pipe each with no other connection. This is a single pipe system as far as the radiators are concerned, but, of course, there has to be an independent rising steam-main to supply steam to the upper end of the descending main or mains, and its only effect is to avoid having steam and water going in opposite directions in the same pipe. If by "overhead system" our correspondent simply means putting coils or radiators in the upper part of the room to be heated, there is no patent on that.—ED.]

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ADDRESS OF HEATING BOILER MANU-FACTURERS WANTED.

SALT LAKE CITY, February 10, 1888.

SIR: We desire you to send us the names of those firms in New York, or anywhere in the East, who manufacture boilers for heating residences and public buildings with hot water. We desire to get the control of a boiler that will be suitable for burning soft coal, and yet one that will be efficient in the consumption of fuel. We take the be efficient in the consumption of fuel. We take the liberty of troubling you for the information, as we believe you to be posted in regard to those who manufacture this form of apparatus. Any expense of labor or otherwise connected with furnishing the above information will be gladly paid, as we are anxious to correspond with those MIDGLEY & SONS.

[We suggest that you examine our advertising columns.]

WHO MAKES THE McGANN WATER-CLOSET?

PITTSBURG, PA., February 15, 1888.

SIR: We are subscribers to your paper, and would respectfully ask if you could oblige us with the address of the manufacturer of the McGann water-closet?

LAWRENCE & WATSON.

[Referred to our readers.]

ICE-MACHINES.

FORT RINGGOLD, TEX., February to, 1888.

SIR: Mr. Jacob Scheuhle, of San Antono, Tex., is the manufacturer of a simple and excellent ice-machine. It is in use at this post and gives satisfaction.

A SUBSCRIBER.

[Answering inquiry on page 121.]

MANUAL TRAINING IN PUBLIC SCHOOLS.

THE exhibition of drawing, clay modeling, and other specimens of manual work by the pupils of the public schools of Columbus, Ohio, and St. Louis, Mo., began February 28 at the rooms of the Board of Education, New York City, to be continued for a few days. The drawings were very interesting, as showing the progress made by the pupils in cities where the manual training system has been in use for three or four years. A similar system is about to be tried in New York City by opening a work-shop in one of the grammar schools.

TRESPASSERS FINED FOR CUTTING LUMBER ON STATE LANDS.

THE first money from trespassers on the State lands of New York was received by the Forest Commissioners February 24. A lumbering firm, who had been cutting timber on State lands, sent \$822 to the commission with the request that it be not proceeded against. This is a good beginning.

A NEW MAP OF MASSACHUSETTS.

THE third annual report of the Commissioners of the State Topographical Survey announces the practical completion of the work of preparation of a new map of the The work was begun in 1884 with the co-operation of the United States Geological Survey, the National Government agreeing to pay half the cost up to \$80,000 and the whole cost above that amount. The area of the State is 8,315 square miles. Besides completing this area the survey has been extended into the adjoining States of New York, Vermont, New Hampshire, Rhode Island, and Connecticut to a limited extent for the purpose of com pleting certain atlas sheets which project into these States. Thus an area of nearly 600 square miles has been surveyed in addition to that of Massachusetts. The total cost of the work was \$115,400.

LIME KILN CLUB METEOROLOGY.

JUDGE OPENHOUSE CABIFF, chairman of the Committee on Meteorological Disturbances, reported that the thermometer invented especially for the club by Professor Moses Clingstone, of St. Louis, had not been found up Moses Clingstone, of St. Louis, had not been found up to his warrant. During the heated term in August it registered from 8 to 10° below zero right along, and during the cold wave of November it marked 250° above zero for several cays in succession. It had been greased with bear's oil, boiled in milk, and baked in the oven, but there it was at that moment on the wall registering over 100° below zero. He didn't suppose that a difference of 20° or 25° in either heat or cold made any great difference to any member, but such a wide margin as had been recorded was piling it on rather too thick. He recommended that it be cast aside, and that Professor Cling stone be notified to remove it within thirty days.

On motion of Shindig Watkins, who is inventing a col-

On motion of Shindig Watkins, who is inventing a colored man's thermometer himself, the recommendation was adopted .- Detroit Free Press.

A BILL TO REGISTER PLUMBERS AND SUPER-VISE PLUMBING IN THE STATE OF NEW YORK,

THE following is the text of a bill introduced by Senator O'Connor, in the New York Senate, February 15, and referred to the Committee on Public Health, Senator Van

AN ACT to amend an act entitled "an act to secure the registration of plumbers and the supervision of plumbing and drainage in the city of New York.

SECTION 1. Section 1, chapter 450, laws of 1881, entitled "an act to secure the registration of plumbers and supervision of plumbing and drainage in the city of New

ork " is hereby amended so as to read as follows:
"Sec. 1. On or before the first day of September, 1888. every master plumber carrying on his trade in the city of New York shall, under such rules and regulations as the Board of Health shall prescribe, register his name and address at the health department of said city within which such master plumber shall be conducting his business, and after the said date it shall not be lawful for any person to carry on the trade of plumbing in either of the said cities unless his name and address shall be registered as herein-before provided. Every such master plumber applying for before provided. Every such master plumber applying for registration shall be required to pass an examination as to his practical knowledge of plumbing and sanitary laws before a Board of Examiners consisting of three master plumbers, to serve without compensation, a Sanitary Inspector, who shall be a practicing physician, and a Sanitary Engineer, to be appointed by the Board of Health of the city of New York, and no license shall be issued by the Department of Public Works of said city to any plumber not duly registered by the Board of Health of the city of New York."

Sec. 2. Section 6 of the said act is hereby amended so

SEC. 2. Section 6 of the said act is hereby amended so as to read as follows:

"SEC. 6. Any person violating any of the provisions of this act, or of the act hereby amended, shall be deemed guilty of a misdemeanor, and, upon conviction, the name of such person shall be struck from the registry of master plumbers made or kept under the provisions of this act. Any such person, however, within 20 days after the receipt by him of notice of the removal of his name from the registry of master plumbers kept in the city of New York may apply to the said Board of Examiners for reinstatement, and, if upon a review of the facts resulting in the conviction of such person under the provisions of this section, the said Board of Examiners, by the concurrent vote of the members thereof present at any regular meeting of such Examiners, shall certify that such person is entitled to reinstatement and to the restoration of his name to the said registry of master plumbers, then, and in that case, the Board of Health in charge of such registry may duly reinstate such person, and restore his name to the roll of master plumbers."

THE NICARAGUA CANAL.

DISPATCHES to the New York Times from Nicaragua dated January 30 state that all the surveying parties having been established in camps and the work of locating the route progressing favorably, Mr. Peary, who is in charge of the survey, proceeded to Managua on the 15th inst. to pay his respects to the President of the republic and his Cabinet. The journey by rail to the capital was a novel one, and possibly no engineer has ever before traveled in like manner to visit the chief of a nation in whose territory he was inaugurating a great public work. Arriving at Granada the Superintendent of the road, as the scenery could not be viewed from the passenger coach, suggested the cowcatcher as the most available place for looking about, and the offer was accepted at once.

At Masago a delegation arrived on a special train and the cowcatcher had to be abandoned. The President met the party and escorted them to his office and reception room, where Mr. Peary made an address, at which the President expressed his pleasure.

While riding from Granada to Managua, in cuts through the earth about ten feet deep in some places, it was noticed that in all cases the earth was so firm that the sides of the excavations were perpendicular. It is said that this char_ acteristic is not a local one, but that the canal can be built in a similar manner, which will save the expense of excavating more earth than is absolutely needed to form the canal bed.

After leaving Managua Mr. Peary started for Brito, the Pacific terminus of the canal route and made an examina-tion with a view of determining the most expeditious and best location of surveying parties when they shall be transferred there, probably in the early part of April.

THE old method of sinking wells or shafts by a wooden crib surmounted by masonry walls is superseded of late in Belgium by the use of hollow cylindrical sections of cement tubing of the required diameter, smooth externally, with inside collars jointed with liquid cement. As the excavation proceeds sections of the tubing are added at the top until the required depth is obtained, when the opening is closed with a cement slab, having a manhole in the centre.—La Semaine des Constructeurs.

CONVICTIONS OF "SKIN" PLUMBERS CONFIRMED.

"JOHN ELLIS and Thomas White, 141 East Fifty-ninth Street, were arrested for defective plumbing in four houses at the north-east corner of Tenth Avenue and Ninety-third Street, where Inspector H. D. Dickinson found many open joints nearly all filled with putty to deceive the inspector. They were convicted in the Court of Special Sessions December 14 and fined \$250 each."

The above paragraph appeared in our issue of December 31 in an account of the excellent work done by the New York Health Department in securing the punishment of "skin" plumbers. It affords us pleasure to add the. following affirmative opinion from City Judge Rufus B. Cowing, of the Court of General Sessions, to which the cases had been appealed:
"Both of the cases came up to this court on appeal from

judgments of the Court of Special Sessions, and inasmuch as substantially the same questions arise on both appeals,

they may both be disposed of together.

"The appellants seek to reverse the judgments of the

courts below upon various grounds.

"First—They claim that Chapter 450 of the Laws of 1881, and upon which the complaints are predicated, is superseded by Chapter 410 of the Laws of 1882 known a the

Consolidation Act.

"Second—That there is no crime charged in the complaints within the contemplation of either of the above-

named laws.
"Third—That the provisions of Chapter 450 of the Laws "Third—That the provisions of Chapter 450 of the Laws of 1881 and Sections 501 and 537 of the Consolidation Act were repealed by the Penal Code before the happening of the acts complained of in the complaints.

"Fourth—That there is no charge in the complaints specifying a failure to perform the work in accordance with plans approved by the Board of Health.

"Fifth—That the complaints are indefinite and uncertain and give the defendants no information as to the

tain, and give the defendants no information as to the nature of the charge against them; and

Sixth—That there is no crime recited in the warrant

of arrest.
"The foregoing, together with numerous exceptions taken on the trial to the acceptance and rejection of evidence, comprise all the grounds upon which the defendants

(appellants) seek to have the judgments reversed

After a careful examination, I have come to the conclusion that Chapter 450 of the Laws of 1881, upon which sion that Chapter 450 of the Laws of 1881, upon which the complaints are predicated, has never been repealed, either expressly or by implication. The sections in the Consolidation Act, numbered 501 and 537, do not expressly or by implication operate as a repeal of Section 3 in Chapter 450 of the Laws of 1881. The Consolidation Act, as its title indicates, was a declaratory act, all Sections 501 and 632 declare and reaffern substantially Section 5 of and 537 Jeclare and reaffirm substantially Section 3 of chapter 450 of the Laws of 1881 and do not repeal said section either expressly or by implication, and, so far as the Penal Code is concerned, it not only nowhere expressly or by implication repeals the said Law of 1881, but on the or by implication repeals the said Law of 1881, but on the contrary Section 725, Subdivision 4, provides that nothing in the said code affects any acts defining and providing punishment of offenses not defined and made punishable by the code, and inasmuch as the said code nowhere defines and makes punishable the acts described in the third section of Chapter 450 of the Laws of 1881, said section is especially excepted from the operation of the said code. The law never favors the the operation of the said code. The law never favors the repeal of a statute by implication, and where a previous and subsequent statute are not inconsistent or repugnant in the absence of an express repeal they should both stand. I am therefore of the opinion that Chapter 150 of the Laws of 1881 has never been repealed, and that it was at the time of its alleged violation by these defendants in full force

time of its alleged violation by these defendants in fair force and effect.

"The defendants put great stress upon the facts that Section 3 of Chapter 450 of the Laws of 1881 requires the plumbing to be executed in accordance with 'plans' to be approved by the Board of Health, and that the word 'plans' has a fixed meaning and does not include specifications which may be filed with them. I cannot agree with the defendants in the parrow construction of the statute. cations which may be filed with them. I cannot agree with the defendants in the narrow construction of the statute. It will be observed that in the same section there is a reference to 'suitable drawings and descriptions,' and the intent of the Legislature was undoubtedly to include in the word 'plans' whatever was filed with them as a part of them and describing and explaining them. In these cases I am of the opinion that the word 'plan' included the drawings and specifications, and that the two together constituted the plans under which the plumbing was to be executed.

The complaints upon which the defendants were tried and convicted are not justly, in my judgment, subject to the criticism made upon them by the defendant's counsel; they fully and fairly set forth all the facts necessary to bring them within the statute, and they charge the defend-ants with its violation in such manner as to fully inform and apprise them of the nature and character of the charge made against them, and fully and specifically inform them of all the facts necessary to enable them to prepare their defence, and this is all that is required.

"After carefully reading the evidence returned by the Special Sessions, I am convinced that there were no errors committed by the trial court prejudicial to the defendants, and, therefore, the judgments in both cases must be affirmed, and it is so ordered."



ENGINEERS' CLUB OF PHILADELPHIA.

A REGULAR meeting of the club was held February 18, 1888, Vice-President John T. Boyd in the chair; 19 members and 2 visitors present.

Prof. L. M. Haupt presented, by title, the memoirs and summary of papers relating to the re-organization of national public works, presented to the President of the United Stated November 11, 1887; compiled by the Executive Board of the Council of Engineering Societies on National Public Works.

The Secretary presented for Mr. W. H. Ridgway an illustrated description of a direct-acting steam crane, and for Mr. Fred H. Robinson an account of the manufacture of sewer-pipe by the Delaware Terra-Cotta Company.

Mr. Henry G. Morris presented the following under the title of "How Not to Do It."

"The object of this note is to call attention to an example of faulty construction which will, I think, appeal to those interested in the erection of modern buildings where the use of elevators is so universally demanded.

"In a recently completed building in this city can be seen a system of four hydraulic elevators of what is considered approved construction, running in the four corners of a hollow square, the head works being carried by heavy wrought-iron beams extending from one wall to the other.

"The sheaves carrying the hoisting ropes of all four elevators are properly placed on top of the beams mentioned, but owing to the fact that the hoisting ropes are all carried through the west wall it became necessary to place the sheaves carrying the counter-balances of the two elevators nearest the west wall, so that they would not interfere with the ropes of the elevators next the east wall.

"The method of doing this is the point which I desire to criticise. The shafts of these counter-balance sheaves, instead of being so placed as to be supported by the beams, are hung from the bottom by what are apparently cast-iron bearings, attached to the lower flange of beams by means of two three-quarter stud bolts. Aside from the uncertainty of obtaining a good thread when it has to be made in place, as these have evidently been done, there is added the uncertainty of the condition of the same, as well as of the bolts, by reason of the combination of 'the monkey wrench, and the intelligent workman' who may have made the final adjustment.

"In such cases where so many safety appliances are attached to prevent accidents, the faulty construction noted would seem to call for prompt remedy, as the giving way of the suspension boxes or bolts by reason of a sudden jar could hardly fail to cause an alarming accident, if not resulting in loss of life. A little forethought on the part of the designer of the machinery, or of the architect, would have suggested in this case a ready means of overcoming the difficulty encountered."

Professor L. M. Haupt read some extracts from the report of the Commission appointed by the State of New York to provide for the internal navigation of the State, dated Albanv, March, 1812, and signed by Gouverneur Morris, Schuyler Van Rensselaer, De Witt Clinton, Simeon De Witt, W. North, Thomas Eddy, and Robert R. Livingston, and accompanied by the bill which was prepared for the National Legislature, providing for the construction of an extensive internal system of navigation, to be executed by the several States, and guaranteed by grants of public lands.

He then explained how the benefits of the Erie Canal might be extended to other parts of the country, and believed it would be to the interest of Philadelphia to encourage the completion of a more expensive water route between Lake Michigan and the Mississippi River.

Mr. Howard Murphy expressed the opinion that water transportation in general has been artificially crushed out in this country by railroad influence and manipulation, and that, in the natural course of events, it would in the future regain the natural and important place to which it is entitled.

M. F. W. Whiting noted a recent case in his practice where he examined the attic of a building on account of complaint of the frequent presence of smoke in the room, and found the cause thereof to be that the smoke-flues of the building had been arranged to discharge into that room.

SIR ROBERT RAWLINSON.

AMONGST the official announcements made on the first day of the New Year was one to the effect that the Queen had made Sir Robert Rawlinson a K.C. B. on his retirement from the post of Chief Engineering Inspector to the Local Government Board of Great Britain.

Sir Robert is seventy-six years of age, and while the members of the engineering world generally will regret his retirement, they will, without doubt, appreciate the recognition he has received of his earnest and conscientious life-work in the profession of a sanitary engineer.

This distinguished gentleman, whose communications to the columns of THE ENGINEERING AND BUILDING RECORD will be well remembered by our readers, is thus referred to by our English contemporary, the *Builder*:

The long-expected retirement of Sir Robert Rawlinson from official life is at last about to take place. At the ripe age of seventy-six, Sir Robert thinks it is time to rest from the toils of office. He has held his appointment of Chief Engineering Inspector to the Local Government Board ever since that Board was formed, and his name is synonymous with the progress of sanitary engineering, of which he may be said to be the father.

synonymous with the progress of sanitary engineering, of which he may be said to be the father.

Born in 1811, at Bristol, Robert Rawlinson, whose father was a builder and an engineer, commenced his career at an early period under the paternal eyes. At the age of twenty he was sent to Jesse Hartley, the famous dock engineer, and remained with him at the Liverpool Docks for five years. He was then engaged for four years under Robert Stephenson on the London and Birmingham Railway, now part of the North-Western, and there he was resident engineer on the important cutting near Blisworth. He underpinned upward of a mile in length of rock resting on clay, in a cutting 55 feet deep, and executed the whole of the masonry, bridges, culverts, etc., of the heaviest cutting on the line. When, in 1840, the line was completed, he obtained the appointment of Assistant Surveyor to the Corporation of Liverpool, which post he retained for three years. He then was recommended by Jesse Hartly for the post of Engineer to the Bridgewater Canal Trust, in which he remained for four years, during which time most important works in connection with the feeding of the canal, and its improved working were brought about by him

the Bridgewater Canal Trust, in which he remained for four years, during which time most important works in connection with the feeding of the canal, and its improved working, were brought about by him.

His next public work was in connection with the building of St. George's Hall, Liverpool, of which Mr. Elmes was the architect. In 1847 Mr. Elmes became a victim to consumption, and was compelled to leave this country for a milder climate. Before leaving he confided the completion of his great work to Sir Robert. The late Sir William Tite supposed that young Rawlinson held but a subordinate position, and was clerk of the works, but this Sir Robert has refuted. He has satisfactorily proved that Mr. William Hughes was clerk of the works, and that he himself really took the place of Mr. Elmes, in regard at least to the

constructive portion of the work.

The water-supply of Liverpool next engaged his attention, and he submitted a scheme for supplying the town from Bala Lake and the River Dee. This scheme, the wisdom of which has been justified by events—for Liverpool has had recently to adopt something very similar in taking water from the River Severn—was considered too fast for the wants of Liverpool and was therefore rejected.

the wants of Liverpool, and was therefore rejected.

When, 1848, the Public Health Act was passed, Mr. Rawlinson was appointed first Engineering Inspector, and ever since that date his career has been inseparably bound up with the progress of sanitary engineering. He inspected a great number of towns, commencing with Dover, and completely reorganized the drainage and sanitation of the principal provincial towns of this country. He retained his appointment for seven years, at the end of which he tound his private practice increasing to so enormous an extent that he retired from office and devoted himself to the more lucrative occupation of Consulting Edgineer. He was consulted for upwards of fifty towns, and devised schemes of water-supply for Birmingham and Wolverhampton. The city of Carlisle owes its sewerage system to him, which he completed at a cost of less than £23,000, though other engineers had estimated the cost at as much as £70,000 and £80,000. During this period he constructed upwards of a hundred miles of sewers.

In 1855 Mr. Rawlinson was appointed Engineering Commissioner to the Sanitary Commission that was sent out to the seat of war in the Crimea. The operations of that Commission are matter of history, and it will suffice to say that whereas before the arrival of the Commission the death rate among the troops had reached the alarming figures of 420 per 1,000 per annum, when they left it had declined to but little over 2 per cent. Here Rawlinson was wounded whilst in the pursuit of his duties, and he had to return home to be cured; but his services were not forgotten, and when a Permanent Army Sanitary Commission was formed in 1860 he obtained a seat on it which he has always retained

Mr. Rawlinson's next great work was the administration of the fund raised for the Lancashire cotton famine. He carried out public works in ninety-three Lancashire towns, involving an expenditure of £1,050,000, every penny of which has been refunded. The administrative charges did not amount to more than 3s. 6d. per cent. The cotton operatives were saved from starvation and pauperism, and the Lancashire towns were drained and paved. It is estimated that the streets and roads thus improved represent an area of 800 acres, and a length of 400 miles. For his

distinguished services to his country, Mr. Rawlinson was made a C. B. Subsequently, on the recommendation of Mr. Gladstone, he received the honor of knighthood in 1883.

Sir Robert Rawlinson has served on numerous Commissions, and was Chairman of the Rivers Pollution Commissions of 1865 and 1868, and of the Royal Sanitary Commission of Dublin of 1879. He is a Vice-President of the Society of Arts, and a member of Council of the Institution of Civil Engineers. Sir Robert is the author of numerous scientific reports and papers, and of "Suggestions" for the use of local surveyors and sanitary engineers, which have been accepted as authoritative both in England and abroad. His work on "Chimney Shafts" is also well known.

SUBTERRANEAN DISTURBANCES IN OHIO.

Some remarkable fissures in the earth have recently appeared near Akron, O. They radiate from a common centre, in one place coming up through the cellar of a house, splitting the walls wide open. Where the fissures pass through earth covered by sod, the turf is laid back in long furrows as if thrown back by ploughs. The chasms have been explored to the depth of thirty feet, without reaching bottom. The principal openings are on sandy hills of considerable elevation above the surrounding land and the centre of the disturbance in each case is near the highest part of the hill. The earth covering of the rock in that neighborhood is said to be about forty feet in thickness. Geologists there advance the theory of shale gas which being "sealed" up by the freezing of the ground forces its way out and causes the explosions. But gasdrillers, however, within the last year, not in the immediate field of disturbance, but in the neighborhood, put down a hole 2,100 feet deep and found scarcely enough gas to make a flame. Other similar disturbances have occurred several times previous to this and always in the winter months when the earth is frozen.

THE American Water-Works Association will hold its next meeting in Cleveland, O., on April 17 next.

WILLIAM C. KELLY.

WILLIAM C. KELLY, whose death has been already noticed, is credited with being the discoverer and first user of what is called the Bessemer process of converting pigiron into steel. Mr. Kelly was the proprietor of the Suanee Iron-Works and Union Forge in Lyon Co., Ky., where he made charcoal blooms mainly for boiler-plates. Finding the necessary fuel very expensive, he devised the plan of purifying the molten pig by forcing an air-blast through it which burnt out the carbon, thus producing a low steel in his attempts to make wrought iron without puddling. He continued to use and experiment with this process for ten years despite the discouragements from his friends and advisers, until his customers refused to use blooms not made in the old way, and he was compelled to pursue his investigations secretly.

Shortly after the return to their native country of some skilled English workmen who had been in Mr. Kelly's employ, Henry Bessemer, an English ironmaster, announced the discovery of the process which bears his name, and applied for patents in England and in this country. Mr. Kelly immediately made a claim of priority of invention, which was allowed and the patent granted to him.

Mr. Kelly's process was barely successful until perfected by Robert Musshult, a prominent English ironworker, and he gained from his invention very little of the credit or reward that was justly due to the discoverer of a process that has revolutionized the manufacture of the world's most important industrial product.

PERSONAL.

MAJOR WILLIAM LUDLOW, late Engineer Commissioner of District of Columbia, is now engineer of Fourth Lighthouse District, with station in Philadelphia.

PROFESSOR THOMAS GRAY, of the University of Glasgow, Scotland, has been appointed to the chair of dynamic engineering in the Rose Polytechnic Institute. Terre Haute, and has signified his acceptance of the same.

MR. DOMINGO GARCIA Y CARTAYA, until recently a member of the Nicaragua Canal survey, met with an accidental death at Granada, February 27. Mr. Cartaya was an engineer and chief of one of the parties in the field. About a month ago he resigned on a surgeon's certificate of failing health. He was a resident of New York City.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

RCHITECTURAL COMPETITIONS. GALVESTON, TEX.—Plans are wanted here ntil March 15 for a school building, to cost more than \$35,000. Address R. V. Javidson, as above.

STONE LAKE, IOWA.—Plans are wanted ere until April I for a court-house. Address. W. Warren, as above,

MARSHALL, TEX .- Plans are wanted here or a court-house to cost from \$45,000 to \$60,No date specified. Address Judge eller, as above.

MINNEAPOLIS, MINN.—Plans are wanted ere by the Y. M. C. A. for a new building. o date specified. Address the secretary,

CAMBRIDGE, MASS .- The following archicts have been invited to compete for the new ity Hall, to be erected here at a cost of 150,000: Peabody & Stearns, Van Brunt & owe, Chamberlain & Whidden, Longfellow, lden & Harlow, and John Lyman Faxon.

A PROPOSED CAPE BRETON CITY.

A RECENT dispatch from Halifax to the ew York Times states that a party of Boson capitalists who purpose building up a city id summer resort near Port Mulgrave, on its Straits of Canso, have purchased five miles I and for \$30,000 cash. They have also I and for \$30,000 cash. They have also in chased a coal mine. As this port is the also certain winter port of Cape Breton, they ope to build up a large city. The company trying, it is said, to have the Atlantic erminus of the railway system of Canada there also to have all Atlantic steamers call



or works for which proposals are requested see also the "Proposal Column," pages i-v-viii-223.

Persons who make any use of the information they id in these columns we trust will not omit to me не Engineering & Building Record as the sc

ur readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE. ETC.

ST. IGNACE, MICH.-Frank S. Walker, the ity Clerk of this place, writes us, under date February 23, as follows: "No steps have yet been taken as regards water-works. In authorized now by the Common Council write to water-works parties, and try to get ome company to come and put in a plant, le city giving a franchise. If you know ome good company in the business please let le know."

ROCHESTER, PA.-Concerning the waterorks project here our correspondent writes s follows: "I understand sufficient encourgement has been given the projectors to jus-fy them in going ahead with the enterprise. The attorney for the water-works company is ohn M. Buchanan, Beaver, Pa., or A. W. IcCoy, Rochester, Pa."

ELKTON, MD.—In reference to the water-orks project here our correspondent sends to following information: "At a town meeting held February 22, the report of the comnittee recommending the establishment of ater-works was adopted. The charter of the wn will be amended so as to authorize the with will be antended so as to authorize the win to subscribe a fixed sum annually for a ater-supply for fire purposes. The town ill not issue bonds, and the capital will have be furnished by outside parties. It is not spected that anything will be done until new wn commissioners are elected in April:"

CIMMARON, KAN. — Our correspondent rites from here as follows: "Our city voted ater-works bonds the 18th of this month, nd will place in a plant this spring; probably all be ready in March."

matters here our correspondent writes as fol-lows: "The contract for water LANARK, ILL.—Concerning water-works of Lanark, Ill., was made last fall to Wood & Sneadley, of Dubuque, Iowa. City is bonded to the amount of \$13,500, and bonds sold or contracted for at par. The work has commenced and expected to be finished by June 15, 1888."

CHEYENNE, WY. TER.—The question of obtaining a supply of pure water continues to be the chief theme here. City Engineer Miller, assisted by a committee of the Common Council, has presented a scheme which, it is Council, has presented a scheme which, it is claimed by these gentlemen, will solve the problem. The present supply has been found adequate for the demands of the city in quantity, but the quality has been pronounced unwholesome. The report of Mr. Miller and his assistants recommends a system of filtration. Several other plans are under discussion, and, under the instruction of the council, an expert from the East will be called upon to

GRAFTON, W. VA.-An election will be held here March 20 to settle the water-works question. It is thought that the town will favor the scheme.

ASBURY PARK, N. J .- See our proposal columns for information as to supply of castiron pipes and fittngs, fire hydrants, valves, etc., wanted

ALBANY, N. Y.—At a special meeting of the Common Council, held February 27, called to consider the report of the law committee on the proposed agreement of the city with the Central-Hudson railroad, by which the city, through the special water commission, transfers to the company certain lands in and about Patroon's and Sand Creeks for \$50,000, the committee made a favorable report and the committee made a lavorable report and the contract was ratified. Commissioner Sickles explained the proposed route of the driven well system, which is to be carried to a point on Patroon's Creek near Russell Road, where two reservoirs are to be built, thence to a gate-house at the confluence with Sand Creek road and then down to Tivoli Lake, from which point the city will be supplied. In addition to the \$50,000 consideration the company has given the city the right to lay pipes on their lands and to cross the tracks to carry water to The railroad asks in return that the city give to them a small portion of land near the proposed reservoir. The railroad also proposes to allow city to connect their drains with the proposed new trunk sewer which is being built; also to save the city the cost of conveying the pipes along the line of the new water route, by doing it themselves, which, it put altogether, would amount to about \$100,-

WATER-WORKS,-See our Proposal Column for information regarding water-works and water-works supplies at following places: Bristol, Tenn.; Washington, Mo.; Iron Mountain, Mich; Americus, Ga.; Lapeer, Mich.; Fernandina, Fla.; Jersey, City, N. J.; St. Louis, Mo.; Providence, R. I.; Washington,

NEW LONDON, CONN.—It is probable that considerable sewer work will be done here this spring. For details address the Sewer Board.

PHENIX, N. Y.-Basset Bros., of Buffalo, are preparing plans for a complete system of water-works to be built here next summer.

MONTGOMERY, ALA.—The sum of \$75,000 has been appropriated by the City Council for the construction of additional sewers, for which plans and specifications have been made by Rudolph Hering. For details ad-dress the Committee on Sanitation.

GREENVILLE, MISS. - As soon as the weather permits the water-works company will begin laying pipe throughout the city. The water for fire purposes will be taken from the river and artesian wells will be driven to obtain a supply for drinking purposes. The machinery used will be the Gordon-Maxwell pumps, in connection with the Hayne safety boilers.

TRENTON, N. J .- As announced in our Proposal Columns last and again this week, several thousand dollars' worth of sewerage works is to be done here at once.

JERSEY CITY, N. J.—At a recent meeting of the Board of Public Works it was decided to postpone the question of a system of filtra-tion of the water-supply for three weeks in order to obtain further information concerning the question. The reason for the postponement was because Andrews Brothers & Co., ment was because Andrews Brothers & Co., of the Oliphant Filtering Company, wanted an opportunity to present a bid, and also desired the Board of Works to visit Springfield, L. I., to investigate the system of filtration used by this company in supplying Brooklyn with a portion of its water.

CANTON, O.—Bonds in the amount of \$50,000 will probably be issued by the city for the purpose of constructing a main sewer. The Sewer Commissioners can give details. William Dannemiller is chairman.

HOWELL, MICH.—The question of establishing a \$25,000 system of water-works here is to be decided at the polls on March 5.

PANA, ILL.—It is reported that water-works are to be erected here. Address the Town

VINTON, IOWA .- It is said that H. T. Lauderbaugh can give details of a water-works project here.

INDIANOLA, NEB.—Water-works are to be established here.

GREENPORT, N. Y.—Water-works will probably be established here. For details address Mr. Wells, of the committee in charge.

FORT FAIRCHILD, ME.—The water-works question is being agitated here. Address the City Clerk for details.

ALEXANDER, ARK.—The water-works question is being agitated here.

KEYPORT, N. J.—The water-works question is being agitated here. Address Mr. Lufburrow for details.

LIVERMORE FALLS, ME.—Concerning the report that water-works were to be erected here the Town Clerk writes: "Some talk has been made in regard to water-works, but no steps of a definite character have been taken as

WOODHAVEN, N. V .- The Woodhaven Water-Supply Company has been incorporated, with a capital stock of \$50,000. Florian Grosjean and others are interested.

NEW BRUNSWICK, N. J .- The break in the water-works dam here has not as vet been repaired, and it is stated that an engineer is to be employed to devise a means of speedy re-

BATESVILLE, ARK.—It is reported that water-works are to be erected here, and that A. A. Webber can furnish details.

KUTZTOWN, PA .-- The question of establishing a system of water-works here is being agitated. For details address Dr. J. S. Trexler.

ASHEVILLE, N.C.—It is reported that this place will probably expend \$60,000 on a place win prosent sewerage syetem.

BRIDGES.

DAYTONIA, FLA.—Address W. F. Stewart for details of a bridge to be erected here.

MOUNT MORRIS, N. Y .- It is reported that a \$20,000 bridge is to be erected here.

HARRISON, N. J.—It is probable that a bridge will be erected over the Passaic River by the Freeholders of Hudson and Essex Counties. The structure is to cost \$100,000.

NEW LONDON, CONN.—The N. V., P. & B. R. R. will erect a large bridge over the Thames.

BAY CITY, MICH .-- Concerning the bridge election here, our correspondent writes: "Bridge question voted upon by the people February 20 was carried."

GAINESVILLE, ALA.—A bridge is to be erected over the Noxubee River. Address the County Commissioners for details.

RACINE, WIS .- The city will build a bridge across Root River at the end of Sixth Street.

BRIDGES.—See our Proposal Column for information regarding bridges at following places: Thomaston, Ga.; Montreal, Can.; Las Animas, Col. MAURICETOWN, N. J.—Concerning the proposed bridge over the Maurice River, our correspondent writes as follows: "The Board of Freeholders of the county of Cumberland lately decided to build an iron bridge over the Maurice River at this place, and have appointed a committee to procure plans and to ascertain the probable cost of building same from bridge building companies. Freeholder William B. Trenchard, of Bridgeton, N. J., is chairman of the committee so appointed."

RAILROADS, CANALS, ETC.

SPRAGUE, W. T .- The Northern Pacific Railroad Company will construct a line from this place to Salmon City, Idaho. F. P. Weymouth, this city, Superintendent.

STREET-WORK AND PAVING.

NEW BEDFORD, MASS .- About \$50,000 will be spent on street improvements here this spring.

GAS AND ELECTRIC-LIGHTING.

BUCKSPORT, ME.—Address Geo. H. Grant, Bar Harbor, Me., for details of an electric light plant to be erected here.

GREENVILLE, MISS.—The Greenville Electric Light and Power Company will erect an 80-light plant here. and will illuminate the public streets, etc., having secured a franchise from the city.

DULUTH, MINN.—Additional works will be erected here by the Duluth Gas and Water

WILLIAMSTOWN, MASS.—An electtic light company with a capital of \$15,000 has been organized here with C. H. Cole, President.

INDIANOLA, NEB —An electric light plant will be established here.

BERTROL, O .- Joseph Clare is at the head of a natural gas company organized here.

MARSHFIELD, Wis.—It is reported that an electric light plant will be erected here.

MAUMEE, O.—The local gas works will be extended.

PANA, Il.L.—Reports say that an electric-light plant will be established here.

BIDS OPENED.

CINCINNATI, O.—At a meeting of the Board of City Hall Trustees, held February 23, contracts for work on the new City Hall were awarded as follows:

awarded as follows:
David Hummel, concreting, foundations, brick-work, and cut-stone work, \$326,500; M. Clements, iron-work, \$125,700; P. T. Scahill, interior concreting, \$10,475; James Hunter, copper and Virginia slate, \$17,498; J. H. Finnigan & Co., fire proofing, \$18,645; F. Schillinger, asphalt, \$2,000.

With the exception of Schillinger the contractors are all Cincinnati men.

CINCINNATI, O .- Only one bid was submitted for furnishing a 10,000,000-gallon pumping-engine for the Hunt Street Station, opened February 23, by the Board of Public

Henry R. Worthington, New York, was the bidder. He proposed an alternate bid, first, \$37,325, and second, \$42,100, the latter to give greater economy in the use of fuel. The bid was referred to the Superintendent of Water. Works for report Water-Works for report.

NEW YORK CITY.—The following bids for laying water-mains in Tenth, Fourth, West End, and Westchester Avenues, and 176th, 116th, 72d, 67th, and 53d Streets, and on Riverside Drive were opened February 28 by the Department of Public Works. The specifications called for the following materials and labor: 1,800 cubic yards rock excavation, 11,-000 cubic yards of earth excavation, 1 cubic yards of filling, 5,500 lineal feet 12-inch pipe, 16,500 lineal feet 6 inch pipe, twelve 12-inch stop-cocks and boxes, forty 6-inch stop-cocks and boxes, 40 hydrants, 10 cubic yards brick masonry, 24,000 square yards of pavement and flagging to relay, and 400 lineal feet curbing and gutter to reset. The bidders were as follows: B. Mahon, \$23,855; J. Cornwell, \$21,691; F. Thilmann, Jr., \$20,435.

WASHINGTON, LA.-The following was the only bid submitted for erecting an iron draw-bridge here, opened by Leon Wolf: King Iron Bridge and Manufacturing Co., \$5,600.

Digitized by GOGIC

CINCINNATI, O .- The following bids for gasoline lighting for one year were opened February 24 by the Common Council:

John C. Broderick, ex-Councilman, bid at \$20 per lamp all night; moonlight, \$17; posts,

\$2.15 each.
Rufus Burkhardt, all night, \$11; moonlight

Rutus Burkhardt, air night, \$11, mooningst table, \$6.50; posts, \$2. Frank Fogerty, all night, \$16.42; moon-light, \$13; posts, \$2. Sun Vapor Light Company, Canton, O., all night, \$21.50; moonlight, \$20; posts, \$2. The bids have been referred to a special

committee for consideration.

CINCINNATI, O.—At a meeting of the Board of Public Works, held February 23, Arthur G. Moore, Superintendent and Engineer of the Water Department, submitted his report on bids for the new boilers for the Front Street station. The report recommended the award of contract to the Heine Safety Boiler Company at \$17,115, with the proviso that award of contract to the Heine Safety Bolier
Company at \$17,115, with the proviso that
the board shall reserve the privilege of reducing the amount of boiler bid if so desired.
It also recommended the rejection of all bids for the Hunt Street Station, and the reference of the whole subject to a committee of the board. It was referred to the committee of the whole, to be taken up at the pleasure of the Board.

NEW YORK CITY.-The following bids for NEW YORK CITY.—The blooming bids for furnishing 3,000 cnbic feet of rock-faced ashler cut stone were opened February 28 by the Department of Public Works: Mt. Adam Granite Co., \$1.45 per cubic foot; R. J. Mitchell, \$1.47; G. T. Doak, \$1.57; B. Maher, \$1.90; F. Hilman, \$1.65; Geo. F. Masterson. \$2.

NEW YORK CITY .- All the bids submitted NEW YORK CITY.—All the bids submitted to the Department of Public Parks for furnishing stone were rejected Feb. 28, the day of opening, as the Commissioners had decided to make certain alterations in the specifications. For re-advertisement of the proposal notice see our proposal column.

CHILLICOTHE, Mo.—The following contracts have been awarded for work on the Industrial Home for Girls, to be erected in this city, J. D. Fulton, architect, Chillicothe: Steam-heating and plumbing. Doherty & Everets, Kansas City, Mo., \$3.225; stone and sewerage, Thomas Kelley, Chillicothe, \$6,325; brick-work, Howard & Burtoft, Chillicothe, brick-work, Howard & Burtoft, Chillicothe, \$5,875; lumber and carpenter-work, Richards & Glore, Chillicothe, \$7,905; slate roof and galvanized iron work, Kansas City Roofing Co., Kansas City, Mo., \$2,350; plastering, J. F. Sims, Chillicothe, \$1,200; painting and glazing, J. T. Churchill, St. Joseph, Mo., \$2,405.

MILWAUKEE, WIS.—The following bids for furnishing the city with two four-wheeled hose-carriages, for the use of the Fire Department, were opened February 24: Babcock Fire Extinguishing Co., \$1,600; Boston Woven Hose Co., \$1,575.10; E. B. Preston & Co., Chicago. \$1,580; the Silsby Manufacturing Co., \$1,350. informal bid, no bonds; Charles Abresch, Milwaukee, \$1,570. The contract was let to Charles Abresch

BOSTON, MASS.-The Paving Department BOSTON, MASS.—Ine Paving Department received the following proposals for 60,000 paving blocks: S. & R. J. Lombard, \$48 per M.; Shields & Carroll, \$44.37; James J. Vernon, \$58. The contract was awarded to Shields & Carroll.

The Park Commissioners also received the following proposals for furnishing granite curbstones: A. A. Libby & Co., \$1.59; Rockport Granite Co., \$1.69; C. J. Hall, \$1.65; Cape Ann Granite Co., \$1.70; Pigeon Hill Granite Co., \$2.59; Matthews, Paradise & Co., \$1.50; James A. Colsom, \$1.70; Maine and N. H. Granite Co., \$1.90; John Shields, \$1.83; James J. Vernon, \$1.69; Lanesville Granite Co., \$1.79. The contract was not awarded. The Park Commissioners also received the awarded.

BOSTON, MASS.—The Sewer Department has received the following bids for removing rock excavation along the line of Stony Brook: Moulton & O'Mahoney, \$2.33 per yard; Thomas A. Rowe, \$2.75; Shields & Carroll, \$3.14; O'Riordan & Killian, \$5.32½; E. C. Munson, \$3.71; Hugh Naun, \$3.85; W. S. Wentworth, \$4.75; S. Sanborn, \$4.75; and Metropolitan Construction Co., \$4.57. Moulton & O'Mahoney received the contract. BOSTON, MASS .- The Sewer Department

BOSTON, MASS. - The Park Commissioners BOSTON, MASS.—Ine Park Commissioners received the following proposals for an iron bridge over the Boston, Revere Beach and Lynn Railroad at Wood Island Park, East Boston: Berlin Iron Bridge Co., Berlin, Ct., \$2,022; Cofrode & Saylor, Philadelphia,

\$2,075; Atlantic Works, East Boston, \$2,991; Boston Bridge Co., \$2,636; King Iron Bridge Co., Cleveland, \$2.980; R. F. Hawkins, Springfield, \$2,710.

NEW YORK CITY. — The following bids were opened by the Aqueduct Commissioners February 29 for furnishing and delivering and laying 48-inch cast-iron pipes and their appurtenances from One Hundred and Thirty-fifth Street and Convent Avenue to the proposed gate-house in the Central Park Reservoir, and doing all other work in connection therewith, necessary to complete Section 16 of the New

necessary to complete Section 16 of the New Croton Aqueduct, as called for in the approved forms of contract and specifications. The bidders were as follows: Mathew Baird, \$1.104,995; Miles Tierney, \$1,123,510; O'Brien & Clark, \$1.052,365; Ripley, Andrews & Co., \$1,081,285; McNeal Pipe and Foundry Co., \$1,261,395.

For furnishing and delivering cast-iron pipes and special pipe castings, to be used on Section 16 and Section 17 of the New Aqueduct, at such places in the city of New York as may be designated by the Aqueduct Commissioners, and as provided for in the approved form of contract and specifications, The bidders were as follows: Walter Wood. \$683,660; Warren Foundry and Machine Co., \$674,730; McNeal Pipe & Foundry Co.,

\$674,730; McNeal Pipe & Foundry Co., \$688,650; Q. C. Iron Co., \$710.065.
For handling and hauling and laying 48-inch cast-iron pipes and their appurtenances from One Hundred and Thirty-fifth Street and Convent Avenue to the proposed gate-house in the Central Park Reservoir, and for doing all other work in connection therewith, necessary to complete Section 16 of the New Croton Aqueduct, as called for in the approved forms Aqueduct, as called for in the approved forms of contract and specifications. The bidders were as follows: Mathew Baird, \$453,420; J. M. Caldwell. \$762,845; H. H. Brown, \$516,988; W. E. Dean, \$315,648,25; R. A. Malone, \$552,790; John Cox & Co., \$428,000; Ripley, Audrews & Co., \$380,320.

PIPESTONE, MINN.—Allan Black, of St. Paul, Minn,, has been awarded the contract for the plumbing and steam heating in the Calumet House, in this city, for \$5,000.

New YORK CITY.—As no bids were received by James C. Bayles, President of the Health Department for dredging in Mott Haven Canal the matter has been handed over to the Department of Parks, which will advertise for proposals for the work.

FLUSHING, L. I.—The contract for constructing an electric street railway between College Point and through this village has been awarded to ex-trustee Dennis Sullivan, by Supervisor Joseph Dykes, President of the Flushing and College Point Street Railroad Company. The road is to be about four miles in length, with steel rails and first-class furnishings, and the contract was awarded for furnishings, and the contract was awarded for \$8,000 per mile. Work is to begin at once, and the specifications call for its completion by May 15. Electricity is to be the motive power.

GOVERNMENT WORK.

TOMPKINSVILLE, N. Y.—Abstract of bids received by Major D. P. Heap, U. S. A., Engineer Third Lighthouse District, February 23, 1888, for all labor and material for completing engine-house at Statue of Liberty, Bedloe's Island, N. Y.:

Morris Jacoby, 1542 Second Avenue, N. Y. City, \$14,327.50; Frank Rinschler, Stapleton, N. Y., \$12,443; John H. Deeves & Brother, 156 East One Hundred and Nineteenth Street, N. Y., \$15,500; Robert Moore, West New

156 East One Hundred and Nineteenth Street, N. Y., \$15,500; Robert Moore, West New Brighton, N. Y., \$11,400; H. C. Livesey, 31 & 33 Broadway, N. Y., \$14,800; S. J. McGuire & Co., 170 Greene Street, N. Y., \$12,-975; Linus Seeley, Woodfords, Me., \$16,522; Francis H. Smith, 16 & 18 Exchange Place, N. Y., \$15,800; John G. Vaughan, Stapleton, N. Y., \$10,880; Philip Wolf, Stapleton, N. Y., \$10,880; Philip Wolf, Stapleton, N. Y., \$16,000; D. C. Weeks & Son, Moot Avenue and One Hundred and Sixty-third Street, N. Y., \$18,435; E. D. Garnsey & Bro., 342 East Thirty-fourth Street, N. Y., \$17,500.

PROVIDENCE, R. I.—The following bids for a fire-proof and burglar safe for the Collector's Office were opened February 25 by the Supervising Architect of the Treasury Department: Barnes Safe and Lock Co., \$900; L. H. Miller, \$795; Farrell & Co., \$792.

CHARLESTON, S. C.-The following bids for a fire-proof safe, with a burglar-proof safe, for the post-office were opened February 25 by the Supervising Architect of the Treasury Department; Marrian Safe Co., \$875; Mosler Brown & Co., \$865; Farrell & Co., \$718.

TRENTON, N. J .- The following bids for a fire proof safe, with a burglar-proof chest, for the post-office were opened February 25, by the Supervising Architect of the Treasury Department ;L. H. Miller, \$235; Mosler, Brown & Co., \$200; Farrell & Co. \$150.

WASHINGTON, D. C .- The following bids washington, D. C.—The tollowing bids were opened March I at the Navy Department for 16-inch gun lathes: Group I, turning and boring lathes for 16-inch B. L. R. jackets; group 2, turning and boring lathes for 16-inch B. L. R. jackets; group 3, turning and boring lathes for 16-inch B. L. R. straps.

Binsee & Houschild, Harrison, N. I., group 3, 3 lathes, \$45,000; 4 lathes, \$56,000; 7 lathes, \$100,000.

Niles Tool-Works, Hamilton, O., group 1, 1 lathe, \$69,500; 2 lathes, \$137,000; 3 lathes, \$205,600; 4 lathes, \$273,000; 5 lathes, \$341,-000; 6 lathes, \$406,800. Group 2, I lathe, \$42,000; 2 lathes, \$83,000; 3 lathes, \$123,000. Group 3, 3 lathes, a, \$78,000; b, \$93,000; 4 lathes, a, \$103,000; b, \$123,000; 7 lathes, a,

lathes, a, \$103,000; b, \$123,000; 7 lathes, a, \$180,000; b, \$215,000.

Bement Miles & Co., Philadelphia, group I, I lathe, \$71,000; 2 lathes, \$139,500; 3 lathes; \$209,300; 4 lathes, \$279,800; 5 lathes, \$349,800; 6 lathes, \$410,800. Group 2, I lathe, \$39,500; 2 lathes, \$78,500; 3 lathes, \$117,500. Group 3, 3 lathes, a, \$81,000; b, \$96,000; 4 lathes, a, \$135,000; b, \$140,000; 7 lathes, a, \$180,000; b, \$204,000.

The Pond Machine Tool Co.; Plainfield, N. L., group, I, I lathe, \$70,000; 2 lathes,

The Pond Machine Tool Co.; Plainfield, N. J., group 1, I lathe, \$70,000; 2 lathes, \$139,000; 3 lathes, \$2276,800; 4 lathes, \$276,200; 5 lathes, \$345,200; 6 lathes, \$414,200; group 2, I lathe, \$41,000; 2 lathes, \$60,500; 3 lathes, \$120,500; group 3, 3 lathes, a, \$76,500; b, \$91.500; 4 lathes, a, \$101,700; b, \$121,300; 7 lathes, a, \$177,100; b, \$211,300. Southwark Foundry and Machine Company, Philadelphia, group 1, I lathe, \$101,050; 2 Southwark Foundry and Machine Company, Philadelphia, group I, I lathe, \$101,959; 2 lathes, \$174,786; 3 lathes, \$240,330; 4 lathes, \$291,312; 5 lathes, \$364,140; 6 lathes, \$436,988. Group 2, I lathe, \$63,646; 2 lathes, \$109,108; 3 lathes, \$136,383. Group 3, 3 lathes, \$77,200; 4 lathes, \$93,576; 7 lathes, \$162,758

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house; apar hent-house: ten, tenement; e, each e, owner; a, architect; b, builder; fr, frame.

NEW YORK.

East Houston, s e cor Allen st, I br dwell and store: cost, \$25,000; o, Henry Deverberg; a, Fred Ebeling.

27 Monroe, I br store and workshop; cost, \$7,500; o, Ascher Weinstein; a, Henry Dud-

342-344 W 40th st, 1 brick factory; cost \$11,000; o, John Morgan; a, Joseph M Dunn.

217-219 E 70th, 2 b s flats; cost, \$18,000 each; o, Samuel W Waldron; a, G A Schell-

3d av, n e cor 82d, 2 br flats; cost, corner bldg, \$40.000; other, \$20,000; o, Frank E Wise; a, G A Schellenger.

Washington av, w s, 250 n 180th, 2 frame dwells; cost, \$5,300 each; o, Sereno D Bonfils; a, Frank F Ward.

S w cor Lincoln av and 134th, br ten; cost, \$10,000; o, Geo Shepherd; a, Jos M Dunn. 143 to 153 Lincoln av, 6 br tens; cost, \$45,000 all; o and a, as above.

N s 143d, 350 w 7th av, br ten; cost, \$9,500; o, Daniel Steiss; a, Bart Walther.

N s 98th, 125 w 2d av. br ten; cost, \$14.000; o, Annie Fox; a, A B Ogden & Son,

N s 133d, 100 e 6th av, 3 br flats; cost. \$60,000 all; o, Harry Hawks; a, John C

N s 145th, 425 e Willis av, br ten; cost, 0,000; o, Thos Drescher; a, Geo A **\$**0,000; 0,

S s Powell pl, nr Heath av, and on Heath av, nr Powell pl, 10 fr dwells; cost, \$40,000 all; o, Mary A Walker; a, F W Beall.

ALTERATIONS-NEW YORK.

8 W 28th, br dwell; cost, \$16,000; o, Robt Hoe; a, Chas W Rouney.

293 to 297 Monroe, br factory; cost, \$18,000; o, Jac Henkell; a, J. Boekel & Sons.

BUILDING INTELLIGENCE

32 Nassau, br office bldg; cost, \$300 o, Mutual Life Ins Co: a, Chas W Child

48 Wall, br office bldg; cost, \$7.07
Bank of N Y; a, Stent, Dixon & De Nation 8 Union sq. br office bldg; cost, \$6.00.

Jos F Chattellier; a, Ernest Greis.

2 Union sq, br store; cost, \$10,000; c Margaret Smith; a, W Wheeler Smith

BROOKLYN.

S s Jefferson, 100 e Knickerbocker a. tens, cost, \$17.500 all; o, Michael Cashin J Van Dueser.

S s McDonough, 25 e Lewis av. 7 dwells; cost, \$108,000 all; o. John F 3, a, Amzi Hill.

Es Kingston av, 106 s Herkimer, 19 dwells; cost, \$11,250 all; o, Tiliy & Laca, Amzi Hill. S e cor Prospect st and Bushwick in

dwells and stores; cost, \$8,000 all; 0, 12 Klein; a, H Vollweiler.

N s Linden st, 19 ft w Bushwick and dwell; cost, \$49.500, all; o, S M Meder F K Irving.

Ne cor Bridge st, 25 ft n Front so dwell; cost, \$13,000, all; o, Hugh 0 k-a, John P Leo.

S s Greene av, 100 ft w Evergrees frame dwell; cost, \$14,000 all; c. Menahan; a, Th Englehardt.

S s Boerum st, 200 ft w Lorimer s frame dwell; cost, \$18,000, all; 0, 600 Grawer; a, Th Englehardt.

S s St. Marks ave, 150 ft w Nostral, bk residence; cost, \$10.000; 0, W. Waring; a, E G W Dietrick. S s Floyd, 121 w Marcy av, 3 fr tens:

\$17,000 all; o and a, same as above

BROOKLYN-ALTERATIONS. 1,143 Schenck st, bk factory: cost, \$; o, P K Tenhart; a, Geo C Bishop.

MISCELLANEOUS. LEXINGTON, VA.-A \$60,000 court-

is to be erected here by the Supervisor Rockbridge County.

YOUNGSTOWN, O .- The directors of Pittsburg, Youngstown and Ashtabula Re road have decided to expend \$130.000 b in the way of improvements, including erection of a new passenger depot, we upon which will be commenced soon.

KANSAS CITY, MO .- S w Boulerari. Drip, 4 br stores; cost, \$18,000; 0, 1/2

107 bldgs costing less than \$2,000.

NEWPORT, R. I .-- Wetmore av, villa 51 mixture of tudor and gothic; cost, orc. \$000; o, Pierre Lorillard; a, Peabot & Stearns, Boston, Mass.

Mrs Wm Gammell, of Providence.

SPRINGFIELD, MASS.—Ingersoil Groat 2 houses, br and wood, 2½-storie one \$8,000 to \$10,000 each; o. J Dand Will McKnight; b, J D and W H McKnight WASHINGTON, D. C.—Cor 3d and Css

n e, 3 3-story br; cost, \$10,500; a. C.\
Frost; a, same.

2000 and 2004 F st., 3 3-story by the cost, \$13,000; o, Dr. Mrs. Keened & McCartney.

Woodley Lane Road, 1 2 stery in bldg; cost, \$30,000; o, G G Hubbar 4 Allen & Kenway; b, Flanagan Bros.

1701-1707 10th st 4 2-story br Eds. cost, \$16,000; o, C A Lemar; a. Pict

526-536 10th st., se, 62-stery br bids cost, \$7,500; o, W C Goodwin: a, same 1000-1010 G st, 5 2-story br bldgs; (28 \$7,500; a, W C C Goodwin; a, same. 79-85 K st, 4 2-story br bidgs; cost \$1

1218-1220 F st, 6-story br bldg: cs \$40,000; o, H Strong; a, Bruce Gall J. McGregor,

815-827 F st. 7 2-story br bldgs. 69 \$17,500; o. Sixbury & Co.

Ninety-one permits less than \$7,000 value during the month of February

BOSTON, MASS.—Sargent, nr Harlm wooden dwell; cost, \$7.000; o, HA liers rish: a, Geo A Copeland; b, HA Gens

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PROPOSALS.

AVING.—Proposals are wanted at Kansas City, until March 31, for about eight miles of spruce leedar-block paving. Address City Clerk, Lang-

IFR.—Proposals are wanted at New York City il March 6, for removing a part of Pier (pid) 36, rth Riv. r, and the shed thereon, and for building a r wooden pier, near the foot of North Moore Street, dress the Department of Docks, Pier 1, North

SYLUM,—Proposals are wanted at Viroqua, Wis., al March 8, for building the Vernon County Insane ylum, according to the plans and specifications. dress Thomas J. Shear, Secretary Building Com-

EWERS.—Proposals are wanted at Greenbush, N., until March 8, tor the construction of a system of rers, according to specifications. Address the Sewer mmissioners.

OUNDATIONS.—Proposals are wanted at Mil-ukee, Wis., until March 9, for constructing the indation for the pumping-works, at the east end of flushing-tunnel. Address the Board of Public

iCHOOL.—Proposals are wanted at Louisville, Ky., til March 5, for the construction of a school building. dress Curtin & Campbell, architects, Bullitt and in Streets, as above.

OURT-HOUSE.—Proposals are wanted at Union y, Tenn., until March 24, for erecting a court-nouse, dress W. H. Gardner, Chairman Building Commit-

COLLEGE.—Proposals are wanted at Winchester, n. until March 15, for building the Kentucky Wessian College, at Winchester, Ky., according to speciations, etc. Address Messrs. Crapsey & Brown, thitects, as above.

PIPE. HYDRANTS, ETC.—Proposals are wanted Providence, R. I., for 600 tons of 6-inch cast-iron ter pipe, 70 water-gat-s, 25 hydrants; also special stings, taps, stops, I ad, lead pipe, and such other iterial as may be required in the laying of water and wer pipes during the current year. Address the eard of Pub.ic Works.

SEWER CONSTRUCTION.—Proposals are wanted little Rock, Ark., until March 23, for constructing werage system and connecting waste-water pipes, icers' quarters, with sewerage. Address W. A. mpson, First Lieutenant, Second Artillery, A. A. M., as above.

WATER-WORKS,—Proposals are wanted at Washgton, Mo., until April 2, for the construction of a mplete system of water-works. Address N. H. agebusch, Clerk of the Committee on Water-Works.

LIGHT-HOUSE.—Proposals are wanted at Boston, ass., until March 20, for furnishing material and 20 for the erection and delivery of the Dier Island ght-House, Boston Harbor, and I ubec Narrows ght-House, Maine. Address W. S. Stanton, Major Engineers, U. S. A., Light-House Engineers, First and Second Districts.

METAL WORK.—Proposals are wanted at Boston, ass., until March 20, for furnishing the materials and bor of all kinds for the completion and delivery of emetal work of the Deer Island Light-House, Bostaltary, and Luoce Nariows Light-House, Marne, ddress W. S. Stauton, Major of Engineers, U. S. A., ght-House Engineers, First and Second Districts, above.

BRIDGE.—Propossls are wanted at Thomaston, a., until March 20 for the erection of a bridge over e Fiint River. Address Joel Mathews, as above.

WATER-WORKS,—Proposals are wanted at Iron ountain, Mich., until April 2 for the construction of complete system of water-works. Address John T. 2008, Chairman Water-Works Committee.

WATER-WORKS.—Proposals are wanted at Amerus, Ga., for the construction of a system of water-orks. No date specified. Address V. B. Harrold, above.

SEWERS.—Proposals are wanted at Fort Riley, an., until March 13 for the construction of sewers for ding to specifications. Address George E. ond, Assistant Quartermaster, U. S. A.

TO RPE DO BOAT.—Proposals are wanted at Wash-gron, D. C., until April 1, for the construction of a ib marine torpedo boat. Address William C. Whit-ty, Secretary of the Navy, as above.

WATER WORKS.—Proposals are wanted at Lager, Mich., until March 15, for the construction of a
mich ete system of water-works. The specifications
celu the following: About 50,000 feet of waterpe, From 10 to 4 inches in diameter; about 18,000 lbs.
isp cial castings, 60 hydrants; 74 gates, from 10 to 4
act in diameter; 74 gat - boxes, one set of pumping
act in diameter; 74 gat - boxes, one set of pumping
so, the laying of said pipe. Address J. B. Moore,
tes a cat Water Board.

W

TER-WORKS.—Proposals are wanted at Fernal a. F. a., for a system of water-works. No date c. S. ed. Address the Mayor for details.

W.F. OUGHT-IRON TANK. — Proposals are any ediat Boston, Mass., until March 12, for erecting wrought-iron tank on Breed's Island. Address H.T. ice keeper ell, Chairman Boston Water Board.

WA TER-SUPPLY.—Proposals are wanted at Jersey ity.—I, J., until March 19, for furnishing a pure and the less one supply of water to fersey City; water to be up lied into Reservoirs Nos. 2 and 3, on Bergen Hill, of the light into the High-service system of distribution pipes of Jersey City, at an effective head in the ligh-service pipes of one hundred feet above with the specifications. Address Martin Finck, lerk Board of Public Works.

POST-OFFICE-Proposals are wanted at Prescott, bt... for the erection of a pc st-office. U.t.i March 8. Well ress A. Gobell, Secretary Department of Public Vorks.

PROPOSALS.

SCHOOL.—Proposals are wanted at Toledo, O., until March 16, for the erection of a twelve-room school house. Address the Board of Education as above.

WOODEN PIER.—Proposals are wanted at New York City, until March 9 for removing the existing pier at the foot of Rivington Street, East River, and for preparing for and building a new wooden pier on the site of said pier; and for repairing the existing crib bulkhead thereat. Address the Department of Docks, Pier A, N. R.

FIRE-ALARM SYSTEM.—Proposals are wanted at Shreveport, La., until March 22, for a fire-alarm system, also fire apparatus. Address A. S. Tooinbs, Chief Engineer, F. D., as above.

SCHOOL BUILDINGS.—Proposals are wanted at Brooklyn, N. Y, until March 6, from masons, carpenters, plumbers, tin roofers, iron stair builders, etc., for work and materials required in the construction of three buildings for the Board of Education. Address William Harkness, Chairman of School House Com-

SCHOOL BUILDING.—Proposals are wanted at Elizabeth, N. J., until March 14. for the election of a school house in the Second Ward in accordance with the plans and specifications, which may be seen at the office of the Secietary of the Board, No. 124 Broad Street, as above.

JETTY.—Proposals are wanted at Kansas City, Mo., until March 7, for the construction of a jetty or retaining wall 4.400 feet long. Said jetty to be composed of piles, matting, or willow fascines and rip-rap. Address J. I. Reynolds, President Riverside Improvement Company, as above.

WATER PIPE.—Proposals are wanted at Cleveland, O., until March 6, for turnishing and delivering such quantity of cast-iron water-pipe from 3 to 12 inches in diameter, with the special castings that may be needed in laying the same, as may be required during the season of 1888. Address John Whitelaw, Water-Works Superintendent and Engineer.

STEAM-HEATING.—Proposals will be received by the School Trustees for the Nitth Ward, New York City, at the Hall of the Board of Education, No. 146 Grand Street, until Monday, March 5, for steam-heating apparatus to be placed in the Annex Building for Grammar School No, 3, in Grove Street.

FIRE-ALARM TELEGRAPH.—Proposals are wanted at Mobile, Ala., until March 31, for furnishing, erecting, etc., a fire-alarm telegraph system, containing 40 signal boxes, 9 engine-house gongs, 2 private gongs, 25 miles of wire and other apparatus to make the system complete. Address John F. Summersell, City Clerk.

ELECTRIC FIRE - ALARM. — Proposals are wanted at Washington, D. C., until March 7, for the introduction of an electric fire-alarm call and police patiol system into the Treasury Building. Address C. S. Eairchild, Secretary Treasury Department.

ALTERATION.—Proposals are wanted at New York City, until March 8, for the alteration of the Willard Parker Hospital, East Sixteenth Street. Ad-dress James C. Bayles, President Health Department.

SUPERSTRUCTURE.—Proposals are wanted at Minneapol's, Minn., until March 7, for constructing 273 fect iron superstructure and the necessary abutments and piers for superstructure of the proposed bridge over the Manitoba and 5t. Louis railroads. Address Andrew Rinker, City Engineer.

MISCELLANEOUS SUPPLIES. Proposals are wanted at the U.S. Military Academy, West Point, N. Y., until March 10, for supplying the Academy with building material, gas and steam-fitting, printing and printing material, chemicals, chemical and electrical apparatus, books and stationery, stone, lime, cement, etc., according to specifications. Address Charles W. Williams, Assistant Quartermaster, U.S. A., Disbursing Officer.

COURT-HOUSE ANNEX.—Proposals are wanted at West Chester, Pa., for the erection, etc., of an annex to the court-house, to cost about \$60,000. No date specified. Address the Chester County Commissioners

COURT-HOUSE AND JAIL.—Proposals are wanted at Wharton, Texas, until March 22, for the crection of a court-house and jail, to cost \$2,500 and \$8 200 respectively. Address E. T. Herner as above.

TRAP-ROCK STONE, ETC.—Proposals are wanted at New York City until March 7, for lurnishing and delivering, where required, broken trap-rock stone, trap-rock screenings and screened gravel of the quality known as Roa Hook Gravel along certain streets in the Twenty-third and Twenty-fourth Wards. Address the Department of Public Parks as above.

IRON BRIDGE.—Proposals are wanted at Montreal, Canada, until March 13, for a highway iron bridge of ninety-five feet total length, with a roadway of fourteen feet clear, with a capacity of ninety pounds to the square foot. Address Joseph Trudeau, Secretary of the municipality.

STONE PIERS.—Proposals are wanted at Montreal, Canada, until March 13, for the construction of two stone piers for a bridge. Address Joseph Trudeau, Secretary-Ireasurer, of the Municipa ity of the Parish of St. Joseph de Chambly, as above.

LAKE TUNNEL —Proposals are wanted at Cleveland, O., until March 24, for turnishing the material and for building a tunnel under Lake Erie, a distance of 9,200 feet, according to specifications. Address John Whitelaw, Superintendent and Engineer Water-Works.

Works.

WATER-WORKS FURNISHINGS.—Proposals are wanted at St. Louis, Mo., until March 13, for 670 tons 36-inch cast-iron coated water-pipes, about 35 ions of 36 inch cast iron coated special castings, and one 36-inch check-vaive. Address Henry Flad, President Board of Public Improvements, as above.

WATER-CLOSET TOWERS. — Proposals are wanted at New York City until March 9, for the con struction of two water-closet towers at Bellevue Hospital. Address the Department of Public Charities and Correction, 66 Third Avenue.

PROPOSALS.

Proposals for Building Sewers.

Proposals for Building Sewers.

Trenton, N. I., February 25, 1888.

The Common Council of the City of Trenton, in the State of New Jersey, will receive, at their meeting, to be held in the City Hall of said city, on I uesday, the twentieth day of March, A. D. 1888, at eight o'clock in the evening, sealed proposals for building in said city the following-named sewers:

A main sewer with about two thousand feet of vitrified pipe of fifteen inches diameter, about two thousand feet of egg-shaped brick sewer from '8 'xz' o' to 2' o'xz' o', about four hundred feet of cast-iron pipe 24' and 42' diameter, about five hundred feet of vitrified relief-pipe 12' and 15' diameter, and with fifteen mail-holes and flushing-basins.

Also a pipe-sewer about eight hundred feet in length, 8' and 10' diameter, with two manl-holes.

Also a pipe-sewer about there thousand feet in length, from 1' 10' xz' o' diameter, with nine manl-holes and flushing-basins.

Also a rain-water drain, to be an egg-shaped brick structure about thirty-three hundred feet in length, from 1' 10' xz' o' to 4' o' x5' o', with thirteen manloles and flushing basins, and eighteen inlets.

Also a rain-water drain, to be an egg-shaped brick structure about one hundred and seventy-five feet in length and about 3' 2' x4' 9'.

Plans and specifications, with a draft of the contract, and of the bonds required to be given, may be seen at the office of the Engineer, at No. 18 West State Street, Trenton, N. J., on and alter March 6, 1888.

Each proposal must be made on a blank form, which will be lurinsh d by the City Clerk, and must be accompanied with a satis actory bond, with at least two sureties, in the sum of five hundred dollars, conditioned that if the proposal be accepted the person or persons making it will execute the contract required to be executed, and furnish the bond required to be furnished within five days after the acceptance of the proposal.

Separate proposals must be made for each of the above-mentioned sewers, but any person submitting

furnished within five days after the acceptance of the proposal.

Separate proposals must be made for each of the above-mentioned sewers, but any person submitting proposals for two or more sewers may stipulate thereon that he shall not be bound to execute any contract unless all of the proposals made by him shall be accepted by the Common Council.

The proposals must not be filed with any city official, but must be delivered by the bidder, or his agent, to the Common Council, at their meeting, above mentioned, when the same shall be called for by the President of the Common Council.

The Common Council reserves the right to reject any or all proposals.

or all proposals.
y order of the Common Council. Dated February 1888.
W. W. L. PHILLIPS,
Chairman Sanitary Committee.

23, 1888. 14

STREET WORK.—Proposals are wanted at Albany, N. Y., until March 10, for the grading of certain streets in the village of Woodhaven, Queens County, N. Y. Upward of 40,000 vards of excavation and filling required. Bids to be mailed direct to owner, W. H. Pitkin, Albany, N. Y.

FACTORY.—Proposals are wanted at Louisville, Ky., until March 15 for the erection of a wagon factory. Address H. Wolters, architect, Courier Journal Building, as above.

TRUSS BRIDGE.—Proposals are wanted at Las Animas, Col., until March 5, for the construction, etc., of a truss bridge over the Arkansas River, near Catlin, 300 teet. Address Board of County Commissioners, Bent County, as above.

GRANITE STONES. -Proposals are wanted at New York City until March 13 for furnishing granite stones for bulkhead or river wall. Address the De-partment of Docks, Pier A., N. R.

BUILDING.—Proposals are wanted at Mobile, Ala., until March to for building a Locktender's house, at Tuskaloosa, Ala., according to specifications. Address A. N. Damrell, Major Corps of Engineers, as above.

BUILDING.—Proposals are wanted at St. Paul, Minn., for the removal of old buildings from premises, excavating for new structure, and building cuib and retaining walls on the Proneer Press Company's property, on the north-east corner of Fourth and Robert Streets, St. Paul, Minn., according to plans and specifications piepared by S. S. Beman, architect. Address the architect at the above city, care of the Pioneer Press.

COURT-HOUSE.—Proposals are wanted at May-field, Ky., until March 20, for the erection of a court-hous-. Address McDonald Brothers, architects, Louis-ville, Ky.

STREET LIGHTING.—Proposals are wanted at Fort Wayne, Ind., for lighting the public streets, etc., with electricity. Address Mayor Muhler.

COURT-HOUSE.—Proposals are wanted at Hunts-ville, Tex., until March 21, for the erection of a court-house. Address E. T. Heiner, architect, Houston, Tex.

BUILDING.—Proposals are wanted at Washington, D. C., until March 27, for the construction of certain improvements to building No. 6, to be used as a hospital, at the U. S. Navai Training Station, Coaster's Harbor Island, Newport, R. 1. Address James Fulton, Paymaster-General, U. S. Army.

BOILERS.—Proposals are wanted at Washington, D. C., until March 27, for the supply at the Navy Yard, Washington, D. C., of five boilers of the Babcock & Wilcox pattern, erected and complete in all respects, including brick work, having an aggregate of 1,040 horse power, the boilers to be arranged in three batteries, there being four boilers in two batteries and one single boiler. Address James Fulton, Paymaster General, U. S. Army.

COURT HOUSE.—Proposals are wanted at Georgetown, Tex., until April 16, for the erection of a court house. Address Doddson & Dudley, Archi-tects, Waco, Tex.

WATER-WORKS FUPNISHINGS.—Proposals are wanted at Providence, R. 1, for furnishing 600 tons 6-inch east--ron water-pipes, 70 water-gates, 25 hydrants, and such quantities of sp-cial castings, taps, stops, lead, lead pipe, and other material as may be required in the laying of water and sewer pipes during the current year. Address Samuel M. Gray, City Engineer.

PROPOSALS.

Louisville Water-Works.

Louisville Water-Works.

TO CONTRACTORS.—Sealed proposals, addressed to the President and Directors of the Louisville Water Co., and endorsed "Proposal for Indiang Inlet and River Work." will be received at the office of said company, 549 Third Street, Louisville, Ky., until 12 o'clock M., of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders or their representatives. Budders are required to state in their proposals, under oath, the names and residences of all the parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each proposal submitted, to enclose a certified check in the sum of one thousand (\$1,000) dollars as a forfeit to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filing up of which the price must be stated both in written words and figures. Any bid submitted otherwise will be declared informal and rejected. The person or persons to whom the contract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sureties, and execute the contract within six days from the date of notification that the work has been awarded to him or them, and in case of failure or neglect so to do he or they will be considered as having abandoned it, and as being in default to the Louisville Water Company to the amount of the check deposited with the proposal as liquidated damages. General plans and detailed drawings, with the specifications, can be examined at the Water Company's office, from 9 a. M. to 5 P. M., until the day the bids are opened. Not less than two bondsmen will be required from the party to whom the contract may be awarded, and the amount of the bond shall be \$5,000, for which sum the bondsmen shall be jointly and severally liabe, as a guarantee that the party entering into a cortrac the right to reject any or all proposals submitted. LOUISVILLE WATER COMPANY, by Charles R.

the right to reject any or all proposals submitted. LOUI-VII.LE WATER COMPANY, by Charles R Long, President.

TO CONTRACTORS.—Scaled proposals, addressed to the President and Directors of the Louisville Water Company, and endorsed "Proposal for building Engine-House and Engines Foundations, will be received at the office of said company, 540 Third Street, Louisville, Kv., until 12 o'clock M., of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders, or their representatives. B'dders are required to state in their proposals, under oath, the names and residences of all the parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each proposal submitted, to +nclose a certified check in the sum of five thousand (\$5,000) dollars, as a forfeit to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond, on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filling up of which the price must be stated, both in written words and figures. Any bid submitted otherwise will be d'clard informal and rejected. The person or persons to whom the contract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sureties, and execute the contract within six days from the date of notification that the work has been awarded to him or them; and in case of failure or neglect so to do, he or they will be considered as having abandoned it, and as being in defauit to the Louisville Water Company to the amount of the check deposited with the proposal, as liquidated damages. General Plans and detailed drawings, with the specifications, can be examined at the Water Company s office, from 9. M. M. to 5 P. M., until the day the bids are opened. Not less than four bondsmen will be required from the party to whom the contract may be awarded; and the amount of the bond shall be \$50,000, for

PANY, by Charles R. Long, President.

TO BUILDERS OF PUMPING ENGINES

Sealed proposals, addressed to the Piesident and Directors of the Lousville Water Company, and indorsed Proposal for Pumping Engine, will be received at the office of the Lou swille Water Company, No. 549 Third Street, Lousville, Ky., until 12 o'clock M. of Monday, the second day of April, 1888, and at that time will be opened and read in the presence of the bidders, or their representatives. Bidders are required to state in their proposals, under oath, the names and res dences of all the parties interested therein, whether as individuals or business firms and companies. Bidders are required, with each priposal submitted, to enclose a certified check in the sum of ten thousand (\$10,000.) dollars, as a forfeit to the Water Company in case of a refusal for any reason to promptly enter into a contract and bond, on the part of any bidder to whom the work may be awarded. Bids must be made upon the accompanying blank form, in the filling up of which the price must be stated, both in written words and figures. Any bid submitted otherwise will be declared informal and rejected. The person or persons to whom the contract may be awarded will be required to appear at the Water Company's office, with acceptable bondsmen as sureties, and execute the contract within six days from date of notification that the work has been awarded to him or them; and in case of faiture or neglect so to do, he or they will be considered as having abandoned it, and as being in default to the Lousville Water Company to the amount of the check deposited with the proposal, as liquidated damages. General plans and detailed drawings, with the specifications, can be examined at the Water Company's office, from 9 A. M. to 5 P. M., until the day the bids are opened. Not less than five bondsmen will be required from the party to whom the contract may be awarded; and the amount of the bond shall be \$100,000, for which sum the bondsmen shall be jointly and severally liable, as a Auaran

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BUILDING INTELLIGENCE.

(Continued from page 223.)

HARRISBURG, PA.—Nothing over \$7,000 to report.

PROVIDENCE, R. 1. — Worcester and Union, br stable; o, Billings Bros; a, Stone, Carpenter and Wilson; b, not let.

10 blds costing less than \$7,000.

HOUGHTON, MICH .- The Michigan Mining Company will erect a \$75,000 mining school here.

MILWAUKEE, WIS —N e cor Jefferson and Knapp, br dwell; cost, \$12,000; o, Edmund Burke; a, not selected; b, open.

Cor Clark and 11th, br church; cost, \$10,-000; o, German Catholic Church, St. Joseph's Parochial Territory; a, not selected.

Cor Grove and Mitchells; br butcher shop; cost, \$7,000; o, Paul Noe; o, A C Clas; b, open.

206 Prospect av, br and st dwell; cost, \$20,000; o, H M Benjamin; a, A C Clas; b, open.

Cedar nr 28th, br dwell; cost, \$10,000; o, B H Eiring; a, A C Clas; b, open. 15 bldgs less than \$7,000.

CHICAGO, ILL.—1054-58 Wilcox av, 3 br dwells; cost, \$10,000; o, T C Dymond; a, Cassel & Son; b, Hammond & Town.

Oakenwald av, nr 43d st, br flats; cost, \$14,000; o, Wm Ilett and W J Taylor; a, Marston; b, Wm Ilett.

286 Armitage av, br store and flats; cost, \$10,000; o, A Delfosse; a, C O Ansen; b, A Delfosse & Son.

227-29 Wabash av, br and stone panorama bldg; cost, \$28,000; o, Chicago Panor Co; a, Bauer & Hill; b, C & A Price.

459-69 24th, br factory; cost, \$10,000; o, M Deneer; a, J A Thayne; b, C A Fox.

46-50 N Halsted, br warehouse; cost, \$16,000; o, Dennis H Hayes; a, J Speyer; b, B H Hayes.

2222 State, br store and flats; cost, \$10,-200; o, Peter Schneider; a, J Doerr; b, Geo

164 Townsend, br flats; cost. \$10,000; o, Olaf Selander; a, Jno Otter; b, Jno Wooddrum.

2217 Dearborn, br flats; cost, \$8,000; o, W H Grimly; a, Jno Frank; b, M Hogan. 606 Sedgwick, br store and flats; cost, \$8,000; o, Jno Schina; a, A F Boos; b, P Ebertshauser.

10-25 Market, br addn to stores; cost, \$30,000; o, Eckhart & Swan; a, S V Shipman; b, Barney & Rodatz.

1195 Milwaukee av, br store and flats; cost; \$12,000; o, Nels Hanson; a, Wm Ohlhaber; b, H Bufer.

47-49 Winthrop pl, br flats; cost, \$10,000; o, J Gubbins; a, C W Palmer; b, J F Gub-

297-99 Laughton, br store and flats; cost, \$12,000; o, Chas J Swanson; a, Ostling Bros; b, Prath & Weiterink.

1298-1302 W Madison, br store and flats cost, \$15,000; o, Isaac McTaskey; a, W H Drake; b, S Webb.

83 buildings costing less than \$7,000.

NEWARK, N. J .- Plans for the new postoffice building to be erected here are about completed. The edifice is to cost \$350,000.

ST. LOUIS, MO.—Morgan & Delmar avs, 2 adj br dwell; cost, \$8,000; o, J M Carpenter; b, J McLane.

Lasalle & Theresa, 3 2 story br dwells; cost, \$8,000; o, St Louis Stone Masons Assoc; b, sub let.

12th and Russell av, a br convent; cost, \$10,000; o, Ursuline Convent; b, J Stander.

19th and Howard, 4 adj br dwell; cost, \$10,000; o, Wm Kessler; b, J Schott.

Jefferson and Geyer avs, br dwell; cost, \$9,500; o, J Grelle; b, Uhri & Son.

17th and Franklin av. br laboratory: cost. \$17,000; J Lumsden; b, J L Kuhnerty.

Park and Jefferson avs, 3 adj br dwells; cost, \$10,000; o, P W Schneider; b, sub let.

GENEVA, N. Y .- Nothing over \$7,000 in value to report.

TOLEDO, O.-A \$200,000 hotel is to be erected here by J K Tillottson.

BUILDING INTELLIGENCE.

BALTIMORE, MD.—Beg cor Charles and Biddle, 3 3-story br and stone bldgs; cost \$8,000; o, Geo J Blake.

Block bounded by Haubert, Decatur, etc., 3-story factory; o, Richard Sauer.

Beg cor Gilmor and Franklin, 7 3-story bldgs; o, W M Warfield.

DETROIT, MICH.—Woodward av, brick stores and flats; cost, \$60,000; o, W H Stevens; a, M L Smith.

Woodward av, br church; cost, \$75,000; o, United Presbyterian; a, Hess & Raseman

NEVADA, MO .- The Nevada Christian University will erect several buildings here, to cost a total of \$100,000.

WILLIAMSPORT, PA. - Nothing over \$7,000 in value to report this week.

EAST ORANGE, N. J .- The trustees of the Grove Street Congregational Church will erect a new edifice to cost about \$30,-000. Address as above for details.

DARLINGTON, WIS.—The Chicago, Milwaukee and St. Paul Railroad Company will erect a hansome passenger and freight depot here.

ST. PAUL, MINN.—The Joseph Schlitz Brewing Company is preparing for the erec-tion of a building in this city, to cost from \$100,000 to \$150,000.

PHILADELPHIA, PA .- 16th and Parrish, 3 story store and hall; b, J King.

Cedar, bet Terrace and Manayunk, 5 2 story dwells; o, Thos Hagerty.

1,611 North Broad, 4 story dwell; b, Porter & Thomson.

A new street, be: Hermit and Adam, 7 2 story dwells; o, Wilby & Mellondew.

Terrace and Manayunk, 2 2 story dwells; o, James Harper.

Terrace, Seville and East, 2 dwells; o, as 117 8th, 4 story br store bldg; b, Ray &

816-826 Market, 2 6 story br stores,

46.8x263 feet; b, Benj Ketcham & Son. Orthodox, bet Washington and Mulberry,

7 2 story dwells; o. Robert T Corson Mulberry, bet Orthodox and Gillingham,

3 2 story dwells; o, as above. Washington, s e of Orthodox, 2 2 story dwells; o, as above.

Orthodox and Mulberry, dwell and store; o, as above.

Bloya, bet Chelton av and Mill; 4 2 story dwells; o, C F Bonsall.

Federal, bet 24th and 25th, 5 2 story dwells; o, Guarantee Improvement Co.

Ashmead, e of Wakefield, 4 2 story dwells; o, Wm West.

American, ab Oxford, 5 story add to factory, 27x120; b, Wm R Dougherty.
Wister and Wakefild, stone church; b,

John D Thomson. Almond and Brick, 5 2 story dwells; o,

Charles Boyce. Manayunk av and Penn, 6 2 story dwells;

o, Robert Boone. 16th, bet Morris and Moore, 25 2 story

dwells; b, John McConaghy. WORCESTER, MASS.—Burncoat, fr dwell; cost, \$8,000; o, F G Davis; a, A P Cutting; b, Urgel Jacques.

Pleasant, br block; cost, \$30,000; o, Mrs R. Lamb; a, E Boyden & Son; b, not let.

MILWAUKEE, WIS.—The Chicago and North-western Railroad Company has had plans made for a \$300,000 depot to be erected in this city. Messrs. Cobb & Frost of Chicago, Ill., are the architects.

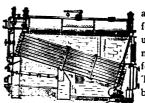
APPLETON, WIS.—The Lawrence University is to build a \$25,000 addition to its bu.lding.

LOWELL, MASS.—Nothing over \$7,000 in value to report.

GREENVILLE, MISS .- A hotel to accommodate 100 guests is to be erected here. Address the Greenville Hotel Company.

KANSAS CITY, MO.—It is reported that the Mass Life Insurance Company will erect an office building here to cost \$1,000,-

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BALTIMORE, MD.

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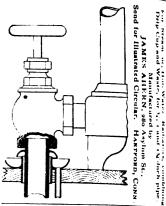
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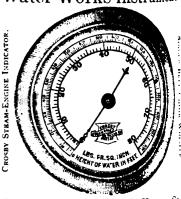
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THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE NEXT CENSUS.

ALTHOUGH more than two years must elapse before the eleventh decennial census of the United States will be taken, it is none too soon to begin to give careful consideration to this subject. A bill has already been introduced in the House of Representatives by Mr. S. S. Cox to provide for the taking of this census, and the Superintendent of the last census, General Francis A. Walker, has published a paper on the subject in the Quarterly Journal of Economics for January of this year.

There has been a good deal of dissatisfaction with the methods and results of the census of 1880, due mainly to the great delays in the publication of the final reports, which delays, as General Walker explains, were due to the financial embarrassments of the census office owing to the fact that the cost of the work had been much underestimated. There were other reasons, it is true, but this was the main one.

The actual cost of the tenth census was not excessive, but it was met by a series of deficiency appropriations, which gave rise to the feeling that there must have been extravagance or mis-

It is very certain that Congress will not authorize for the next census such special reports and semi-statistical investigations as formed a large part of the last one, and the interesting question is, How far and in what direction should the reduction be attempted? The bill introduced by Mr. Cox provides that the schedules of inquiry shall be the same as those used in the last census, with such modifications as the Secretary of the Interior may approve, thus giving the Secretary full discretion as to the inquiries which are to be made. Authority is given for the employment of experts and special agents to collect manufacturing and social statistics, but this is not compulsory, so that if this bill becomes a law the Secretary of the Interior will have full powers to collect data of any kind, subject only to the limitation that the total cost of the work, exclusive of printing and engraving, shall not exceed six millions of dollars. This sum is probably ample. The cost of the last census, excluding printing and engraving, was \$4,853,350, but the work was not all completed. Had all the compilations and reports been prepared which were intended, it would probably have cost a little over five millions of dollars

General Walker seems to be of the opinion that the work of the next census should be devoted exclusively to population statistics and to those of agriculture, and to be very doubtful as to whether it is worth while to attempt to collect mortality statistics by census agencies.

It is very true that the reports of deaths collected by the census are incomplete, and that as to the causes of death they are inaccurate; nevertheless, we think that they do give valuable data, and that, for the next census, at least, it would be very unwise to omit these schedules

If Congress should see fit to authorize the organization of a permanent census bureau it would perhaps be better to have the statistics of machinery, railroads, municipal improvements, etc., collected at another time than that fixed for the enumeration of population, although even then there are great advantages in taking the day on which the population count is made as the centre of the statistical year for such sub-

Meantime we think Mr. Cox has done wisely in leaving these matters to be settled by the Secretary of the Interior and the Superintendent of the Census, and it is to be hoped that his bill will be enacted without material change.

THE POLLUTION OF STREAMS.

THE paper by Mr. Hering, which we print on another page of this number of the paper, fairly sums up the empirical rules which at present would influence an engineer in forming an opinion as to whether a given stream is or is not so polluted as to make it necessary to take steps for its improvement. The first and main consideration is as to whether the stream is or is not used as a source of drinking-water supply. If it is to be so used, it is certain that our present knowledge as to the limit of sewage impurity which may be considered permissible is very vague and wanting in scientific precision, and that there is much need of a series of careful observations on the effect of time and distance of stream-flow on diluted sewage, and especially on such pathogenic bacteria as the sewage of a community is liable to contain. The action of the ordinary bacteria of a sewage effluent is not harmful, but beneficial, and it is probable that there are other forms of bacteria, not contained in large numbers in ordinary sewage, but which are specially valuable as purifiers of such material and which exist in great abundance in those soils in which oxidation and nitrification are rapidly produced.

It is quite possible that these oxidizing bacteria might be cultivated in large quantities and added to sewage, but to enable them to flourish and do their work it is necessary that they should have a large supply of oxygen. This they have in soils which are not allowed to become too moist, but they do not have it in water, unless by agitation or in some other way air is mingled with the

Even with our present imperfect knowledge there is one fact which is tolerably clear, and that is that any stream of small or moderate size which lies in the midst of a populous and growing district is polluted, and will probably become more polluted, that this process is one of gradual increase, and that while we may not be able to predict a definite time in which it will become a nuisance or dangerous to health, we can see that it will become so sooner or later—as, for example, Mr. Hering states such will be the case with the Schuylkill.

The experiments now going on under the direction of the State Board of Health of Massachusetts to obtain a continuous series of chemical and biological analyses of samples taken from different points of polluted streams will probably give results of much value from the point of view in which Mr. Hering considers the question, and it is a pity that a corresponding series of analyses could not be obtained for the Chicago River.

In commending Mr. Hering's paper to the attention of our readers we would only add that while it is very desirable to know what is the maximum proportion of sewage pollution permissible, it is good practice to secure the minimum proportion of pollution that can be ob-

DAY'S WORK VERSUS CONTRACT WORK.

CITY ENGINEER RINKER, of Minneapolis, Minn., has submitted to the City Council a statement showing the cost of laying water-pipe during the year 1887 by contract and by day labor. The City Engineer makes a strong showing for letting by contract. The comparisons were made upon the lines for which proposals were received and that were laid by day's work. Allowing the city the same price for setting hydrants, valves, and for rock excavation as the specifications allowed the contractor for the same work, the cost of lumber and tools being estimated by deducting the amount on hand, as per inventory of the supervisor of water-works, from the actual amount purchased, the comparisons are as follows:

Cost of day labor, 159,570 lineal feet, at an average per foot of 47.03 cents, \$75,038.31; salary of three timekeepers and one roundsman, \$1,308.06; total, \$76,346.37. Cost, if done by contract, as per proposals received, 159,570 lineal feet, averaging 31.12 cents per foot \$51,259; salary of eleven inspectors that would have been required if done by contract, 1,517 days at \$3 per day.

pany,' the officers of both companies were given positions, the price of gas was raised 30 per cent., and a series of experiments begun in making gas of the worst possible illuminating power. The unanimous testimony of consumers is that it is necessary to burn nearly double the amount of gas that they did formerly to produce a light at all possible to read or work by, and the amount of soot given off by the combustion is enormous and very annoying. There is no redress for this swindle, for the proprietors of the Trust are in Philadelphia and the local officials can only shrug their shoulders and say, in reply to complaints of 'poor gas,' that the tests show the gas to be very 'rich,' and it ought to give good light."

A MODEL ARCHITECTURAL COMPETITION.

The generosity of the advertisers of architectural competitions becomes more and more embarrassing. According to the London *Builder* the latest development in this method of making use of the profession is in a recent advertisement for a design for an Armada Tercentenary

THE ARCHITECTURAL LEAGUE.

THE Architectural League held its regular monthly meeting at Morello's, 4 West Twenty-ninth Street, on the evening of the 6th inst., with the President in the chair. Some fifty members were present, who enjoyed a most interesting and entertaining paper on "Houses on the Bosphorus," read by Mr. A. D. F. Hamlin, and illusrated by the aid of a stereopticon.

LONDON CORRESPONDENCE.

THE prospects of a repeal, either in part or whole, of the stringent clauses of the Electric-Lighting Act of 1882 is creating interest and consequent business stir in lighting circles. The latest instance is the floating of the House-to-House Electric-Light Company. This company proposes to establish central stations for the generation and distribution of electricity for lighting purposes. The probability of increasing business is advanced on the returns of the Brighton Electric-Light Company, the promoters stating that the consumption of electricity at Brighton in December, 1887 was 6,372 units, as against



HOUSE OF E. M. HUNTINGTON, JAMAICA PLAIN, MASS.-W. R. EMERSON, ARCHITECT,

\$4,557; total, \$55.810. Difference of cost of day labo over contract, \$20,536.37.

The above comparison is of interest, but would have been of more value had it been made between two similar pieces of work done under like circumstances by contract and by the day, respectively. The relative economy of the two systems depends on circumstances which vary in different places, and while every record of actual experience is of value, it will probably never be safe to say that either system is always preferable.

THE EFFECT OF COMPETITION IN SUPPLY-ING GAS IN YONKERS.

A RELIABLE correspondent in Yonkers writes us as follows:

"The citizens of Yonkers, N. Y., are suffering from an aggravated case of 'Trust.' The old gas company for several years furnished good gas at a pretty high price. A new company entered the field and competition lowered the prices, but the gas was still good. Not long ago a third company was formed and then all three were united under the title of 'The United Gas Improvement Com-

Memorial to be erected on the Hoe, at Plymouth, so which the committee "are prepared to receive gratuitous designs." Many people in this world "are prepared to receive" anything they can get gratuitously, but they do not all state the sact in so candid a manner.

Nevertheless the Building News says there were a large number of "gratuitous" competitors of whose designs that of Mr. Herbert A. Gribble was chosen. It is a dignified and original composition consisting of a boldly-treated pedestal surmounted by an heroic statue of Britannia, standing in an attitude of defence, with the Drake and other Armada worthies are placed on the four faces of the monument, and sitting at its base are two large symbolic figures representative of Naval Warfare and Navigation, sitting one on either side. The inscription, "He blew with His winds and they were scattered," is carved along the frieze over a bas-relief panel, representative of the Armada. At the base are cannon-balls and anchors.

3,175 in December, 1886, while the quarter ending December 31, 1887 totalled 15,757 units, as against 8,795 units in the corresponding quarter 1886. The prospectus frankly recognizes the fact that the light will be more expensive than gas, but points out the per contra of absence of damage by noxious fumes.

An exhibition of motors and addenda, for use in handicrafts, will be held in Munich from August 1 to October 15 next. Exhibits will be in two classes: (1) Prime movers; (2) machine tools and other mechanical appliances. Heavy machinery will only be admitted in the form of models. This embraces apparently motors exceeding 3-horse-power. The exhibition is being organized by the Allgemein-Gewerbeverein, and applications for space must be made not later than March 1 to the directors.

OUR ARCHITECTURAL ILLUSTRATIONS.

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HOUSE OF E. M. HUNTINGTON, JAMAICA PLAIN, MASS.—
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THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

ENTRANCE, EMMERTON HOUSE, SALEM, MASS.

ARTHUR LITTLE, ARCHITECT.



A HIGHWAY BRIDGE FLOOR SYSTEM.

THE City Bridge of Fort Wayne, Ind., for which the Massillon Bridge Company, of Massillon, O., are the contractors, is being built from designs prepared by the engineer of the Bridge Company.

A total distributed load of 100 pounds per square foot on the entire floor, and a concentrated load equal to the weight of a Porter & Aveling road-roller, at any point of roadway; was assumed, and sections determined in accordance. It is an ordinary double-intersection Whipple truss bridge, with 17-foot panels. It has two 5-foot sidewalks, and a 26-foot roadway carrying one streetcar track.

The floor system, by its extreme rigidity, well distributes the concentrated loads and prevents shocks and vibrations.

The roadway is of 3-inch oak plank, laid transversely on 3x4-inch oak joist, spaced about 16 inches in the clear, on 5-inch transverse rolled-steel beams, which are 27 inches apart on longitudinal plate-girder stringers, 24 inches deep and 8 feet apart at centre, and 18 inches deep and 9 feet apart at the sides. The floor girders are 3 feet deep, with reinforced top chord. The sidewalk is of 2½-inch oak plank, laid crosswise on three longitudinal rolled iron stringers, 7 inches deep, a centre beam of 18 pounds per foot, with 10½-pound channels at sides. These rest on the 5-inch steel transverse roadway beams, which project cantileverwise beyond the side longitudinal stringers, and are supported at the truss-posts by angle-iron braces.

Both floor-girders and stringers have thoroughly riveted web connections, and the truss-posts are reinforced by transverse webs and brought down to the bottom of floor-girders, a portion of the web of which is removed to admit lower chord-pin. The lateral rods are double and secured by pins through connecting plates across foot of posts, thus transmitting their strain in the direct lines of lower chords of trusses and floor-girders and avoiding fl-xure of post or twisting of floor-beam. The chord-pin is omitted in plan for sake of clearness.

EXPANSION OF PORTLAND CEMENT AFTER SETTING.

MUCH attention is being devoted to the several failures of Portland cement concrete at Aberdeen, Maryport, and elsewhere, and the analyst has been busy on the subject. The London Engineer states that the presence of an excessive quantity of magnesia seems to be a chief cause of the expansion by absorption of water, and consequent failure of concrete work after more or less considerable lapse of time. Mr. Harrison Hayter mentioned several cases of failure in a discussion at the Institute of Civil Engineers last November. In one case a wall 35 feet in height had been listed two and a half inches, and in all cases a white substance of the consistency of cream was seen in the concrete. An analysis showed that it contained 80 per cent. of magnesia hydrate, consisting of about twothirds magnesian oxide and about one third water. Mr. Hayter recommends the use of cement of a lower tensile strength than is usual, and a chemical as well as a mechanical test. The action of magnesia has been long known. and more than about two per cent, considered a dangerous quantity, so that it seems curious if magnesia is the cause of the failures that an excessive quantity has been allowed to enter into the composition of recent cements. According to the English experiments on Portland cement, republished in a report of the committee of the American Society of Engineers, on compression of cements, etc., the expansion in a mixture of I cement and 3 sand, containing 2 per cent. of magnesia, was about one-twentieth of I per cent., and for a 5 per cent. mixture about 1/2 per cent. The matter is of the greatest importance, especially when we consider the possible effect of expansions of the kind on the foundations of large bridge piers; and although nothing yet indicates any general cause other than the presence of magnesia, we learn that some chemists are busy on the subject and will probably soon publish the results of their inquiries.

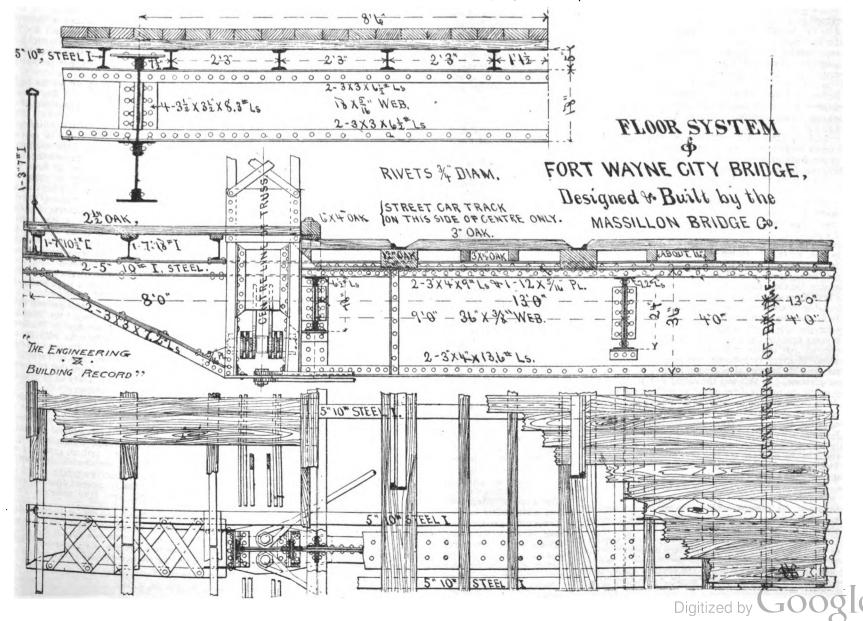
A BELGIAN syndicate is said to have obtained a concession from the Shah of Persia, and to be preparing plans to build a railroad from Teheran to the Holy City.

A METEORIC FURROW.

ON the 25th of October, 1887, about 9 P. M., a bright, white globular body, about half the size of the full moon, and leaving a long train of sparks, was visible in the sky at Tayninh, in Cochin China, for about thirty seconds, moving from west to east. Some days later a letter was received by the Governor of the Province from the Chief of the district of Treisin-Hoa, stating that at the abovementioned time, after considerable rain and thunder, an unknown animal had stopped there in his flight, ploughed up the ground for a distance stated, and disappeared in the sky.

On November 3, R. P. Boutier, an Apostolic missionary, and M. De Larmey, captain of marine artillery, visited the spot and found a vast hole about 32m. long, 6m. wide and 2m. deep, somewhat in the shape of an elongated pear, with two wings. The soil was very moist and thickly matted with roots and turf, and seemed on one side to have sustained great pressure. The ground was roughly torn, and towards the end the earth had been thrown a long distance. The furrow indicated the passage of the aerolite from west to east. The bottom of the furrow had a uniform unbroken surface, and no traces of a foreign body could be found in the vicinity. All the circumstances indicated that a meteor had just touched the earth and richochetted; a theory which is confirmed by MM. Besset and Benout, Secretary of the Arrondissement and artillery officer respectively, who observed it at points 5 kilometres apart, and heard two noises, a sharp report, followed by a rumbling sound, which artillerymen say is characteristic of a richochetting shot when it strikes and leaves the ground.

The Chronique Industrielle, from which this account is taken, states that upon these observations and the measurements of the furrow some very ingenious estimates have been founded, which give the aerolite a length of 32m., maximum diameter of 8m., volume of 579 cu. m., and weight of 2,895 tons; velocity of impact 2,000m. per second; angle of incidence, 10 degrees; velocity after deflection, nearly 2,000m, angle of deflection, 34 degrees; amplitude of ricochet, 1,040 kilometres, which would bring it to the middle of the China Sea.



NOTES ON THE POLLUTION OF STREAMS.*

THE proposition of permanently discharging the sewage of Chicago into the Desplaines and Illinois Rivers recently gave me an occasion to inquire somewhat closely into the existing facts concerning the supposed self-purifi-cation of polluted streams. Owing to circumstances this inquiry is not, and may not, for the present, be completed. While I therefore regret that I cannot give you a paper on the subject, I believe that a few data and some inferences may perhaps interest you at this time and perhaps be of some value, in view of the importance the subject is gaining in many parts of our country. The Ohio River Valley will soon require serious attention. Its numerous cities, some of them quite populous, discharge their sewage into some of them quite populous, discharge their sewage into and take their water supply from the same source. Typhoid fever is unusually prevalent in the valley. Likewise, the Schuylkill River furnishes a number of small cities and finally Philadelphia with water, after receiving above the and the wash-water drainage from 85,000 persons, Here also the death-rate from typhoid fever is high. And a large number of other streams are beginning to cause trouble from similar conditions, though perhaps of less magnitude than those mentioned.

Evidently, it is becoming a pressing question to know with greater certainty just how far we may safely carry this system of pollution or whether we must entirely abandon it. Much work will yet have to be done and many investigations will have to be made before the subject is cleared up, in a way that will allow of a treatment which is just to both those who must have drainage and to those who, residing further down on the samestream, must have

potable water

In discussing the question of water pollution and the setting up of a standard of purity, or of a minimum proportion of sewage, or perhaps of the necessity for its entire exclusion, a distinction must be drawn at the outset. The problem must be viewed very differently when the sewagepolluted water is to be used for potable purposes, or when, as often occurs, it is simply to be inoffensive, not destructive to fish, nor objectionable to manufacturing interests

and to the residents along its course.

With reference to the first case, we have a large number of observations, data, and opinions, yet withal they are insufficient to give a positive answer to the selection of a water-supply in every case. The engineer who is employed to advise on the selection is sometimes confronted with great difficulties from the want of reliable evidence regarding the real danger from pollucion. Is he to reject a pal-atable water and perhaps by far the most economical source of supply because 50 or 100 miles above another community discharges some sewage into it? Is he to be governed at all by the degree of dilution it has received and by the number of days or weeks since the polluted water has had a chance, during its flow, to convert the sewage matter into organic compounds? And is he to consider the agration of a stream as effecting the gradual destruction of disease germs in the same measure as it effects the destruction of the dead organic matter?

Before engineers can receive definite answers to these and other questions from the medical and allied professions, they must, in order to help their clients, continue to say as follows: We know, as for instance in the case of Plymouth, Pa., that clear and tasteless water from a mountain brook may cause an epidemic of typhoid fever by being used for drinking purposes within a few miles of the point where the dejects of a single patient entered the stream. We do not know the conditions under which the dangerous germs may be deprived of their vitality in a living stream. We, therefore, assume, for want of further evidence, that in water, previously polluted, but through dilution or other cause containining a minimum quantity of organic matter and a maximum of dissolved oxygen, the danger from the pathogenic germ gradually vanishes. And to be reasonably safe, we further assume that potable water must not only be of good quality chemically speaking, but that before being used it must have run in the stream for a considerable distance, depending upon circumstances, after it has been even slightly polluted by sewage matter, whether detectable by chemical analysis or not.

In an investigation of the projects for a new water-sup-ply for the city of Philadelphia, which was undertaken a few years ago, the chemical work was supplemented by a survey of 450 square miles of water-shed, showing the location of every farm-house, building, manufactory or other possible sources of pollution in their relation to the other possible sources of pollution in their relation to the water-courses. In this way the actual and possible pollution could be readily determined as well as the practical ways of preventing it in each case. Such surveys, which in a smaller way have often been undertaken, I consider invaluable to the discussion of water-supplies likely to suffer from sewage discharge, and the results should naturally have a far greater weight than those of the chemical analysis of the water at the foot of the drainage area.

The present researches in bacteriology will no doubt The present researches in bacteriology will no doubt soon throw an abundance of light on this question, and the engineer is anxiously awaiting the results, in order that he may solve the practical problems in the selection of a water-supply, if possible with a degree of certainty and safety approaching that which he secures when dealing solely with the laws of mechanics.

The second case I referred to concerns polluted water not to be used for notable purposes, perhaps because it is also

to be used for potable purposes, perhaps because it is alto-

gether impracticable to preserve a high standard of purity or because better sources for a domestic supply are available The Desplaines and Illinois Rivers, for instance, receive the sewage of Chicago and other towns, and no drinking-water is obtained from the same, except some at Peoria, 160 miles below the main sources of pollution. The Blackstone River in Massachusetts also serves as a sewer and will probably always continue to do so, and the Schuylkill River in Pennsylvania will, I believe, likewise have to be entirely abandoned to drain the cities and manufactories

There are a number of other streams in our country which will have to perform this duty, and if there are other and better sources for a city's supply, it cannot reasonably

be objected to on economical grounds.

The question then arises, how much sewage should be permitted in such a case? In other words, what is the proper standard of purity to satisfy the various interests?

This is the subject on which I endeavored to get some light in the Chicago investigations, but, as I said, the data are not complete.

The first point to settle is a proper measure for the permissible pollution. This is best assumed as being the quantity of water which can safely receive the drainage from a unit of population; in other words, the least number of cubic feet of water per minute which should flow down the stream for, say, every 1,000 persons draining into the same.

By using this measure we eliminate the difficulties arising from a varying quantity of water consumption and dilution of sewage before reaching the stream. In England the quantity of sewage ranges from 30 to 60 gallons per head; in America from 50 to 150 gallons per head. But the quantity of refuse per inhabitant does not vary much. Where factories discharge considerable waste matter of a particular kind, or where large slaughtering establishments drain into the rivers, some additional allowance for them may be required, but otherwise the amount of waste matter per inhabitant will be pretty constant, and therefore convenient as a measure.

The problem then is, how much running water must we have to dilute the sewage from every 1,000 persons in or-der to make it inoffensive, not objectionable to manufac-

turing interests, nor destructive to fish?

The standard for inoffensiveness must of necessity be one of personal judgment, and can only be approximate. The admissible sewage pollution of water used for manufacturing purposes depends on the particular industry, some mills requiring a much higher standard than others, and, unless in any particular case the nature of the industry is a governing element, we are again obliged to resort to personal judgment as to what is a fairly clean water for average cases. A standard of pollution which, thirdly, will prevent the destruction of fish depends on the particular species which it is desired to retain. Yet, as we find fish living in sewage polluted water, which is sufficiently diluted to answer the first and second requirements, we can usually ignore this one, except in occasional instances, where it assumes special importance, and where special experiments will become necessary.

There are three ways in which we may get a solution of the problem from this point of view. In the first place we can obtain a sample of the average sewage per inhabitant from a sewer and mix it with enough water to make it what is believed would be unobjectionable, and thus determine the dilution. This method can be applied in small towns; not so well in large cities where the sewage varies in different sections owing to different classes of population and manufactories.

In the second place we can observe the gradual increasing pollution of a water-course caused by the successive discharge of a number of sewers, and, after determining the point at which we find the condition of the river to have become objectionable, either to the senses or for use, we can measure the flow and find the population which

we can measure the flow and find the population which has drained into it at this point.

It is usually difficult to get a satisfactory answer in this way, owing to the imperfect mixture of the sewage with the river water until it has run a long distance. It was intended, however, to make some observations in this man Chicago, where the river serves as the main outfall sewer for the city, with the hope of fair results, notwith-standing the additional difficulties there encountered, due to the frequent stirring up of the sludge by the tugs and vessels. But, owing to want of funds, this, as well as other inquiries, has not been undertaken.

The third way in which we can throw light on the question is to observe the gradual so called self-purification of polluted streams. On this subject, taking a little broader iew than required for the above special purpose, I have

the following notes to present:

It has been asserted in England by Drs. Miller, Odling and Letheby that organic matter of sewage is rapidly oxidized during the flow of a river into which it is discharged, and that if the dilution is at least twenty times, the sew-age* will not only be made inoffensive, but be ut-terly destroyed within a "dozen miles or so." But the Rivers Pollation Commission of Great Britain, in 1878,‡ after a careful direct investigation, prove that this assump-tion is altogether wrong as far as the rapidity of oxidation is concerned, and state that there is no river in England long enough to allow of a complete disappearance of sew-age-matter discharged into it.

The main causes of the apparent disappearance of such matter are dilution, subsidence, and oxidation. Let us consider them for a moment.

sewage. + Report, Vol. VI.

When sewage is discharged into a comparatively large volume of water it becomes dispersed throughout the and lost to sight and even to chemical tests if the dilution great enough.*

The measure of relative dilution can usually be ascer. tained by the mineral salts in solution, and, particularly, by the chlorine in common salt conveyed to the stream by the sewage, because they are not liable to undergo any change which would cause their disappearance.

Subsidence of the heavier organic and mineral matters is sewage has a marked influence in clarifying a polluted It is observed immediately below outfall sewers and is caused by a reduction in the velocity of the sewage after emerging from them, which permits the suspended particles to deposit. This deposit or sludge continues to undergo decomposition until the matter is reduced to its inorganic components. During floods the increased velocity of the water stirs them up, mingles them with the earthy matter generally suspended in flood waters and allows them to be again deposited at another place lower down the river, usually in a less objectionable condition than before Factory refuse often contains chemical agents such as lime, alum, and metallic salts which precipitate much of the sewage matter and thus tend to increase the amount Metallic oxides unite with the sulpheretted hydrogen of decomposing sewage and form insoluble compounds and harmless deposits.

Oxidation and total destruction of sewage matter by de-

composition was for a long time thought to be the main cause for the clarification of polluted rivers. To-day it is known to be but a minor cause compared with dilution and subsidence, and if the sewage is discharged in a fresh condition into a stream of water its destruction is in par. due to fish and other aquatic animals. Some of the refuse from stockyards is disposed of no doubt in this way. Most of the sewage, however, is decomposed or oxidized, as it is usually termed, by the myriads of microscopic plants, microbes, or bacteria contained in both air and water. which at once seize upon the dead organic matter. It is true that chemical changes, not caused by life, assist in converting the organic matter into simpler compounds,

but their effect is comparatively insignificant.

The English River Pollution Commissioners state that sewage oxidation is more active in sunshine than in shade. and is almost arrested at night and when the thermomete approaches the freezing point, showing its dependence on the condition favorable to the lower orders of life. Since then it has been quite conclusively proven that the question of sewage oxidation in a polluted stream or even in the soil of sewage farms, is practically one of a sufficiency of micro-organisms and of air and other conditions that

sustain their life.

Dr. Dupré‡ sterilized sewage and kept it for weeks without the slightest change. By adding a little non-sterilized sewage decomposition at once began. Mr. Warrington has found similar evidence. Dr. Emmich & has shown that sterilized sewage continuously aerated by sterilized air did not oxidize perceptibly nor purify itself

If the aeration of rivers can be kept up to the highest practicable point, it would on a summer day offer the most favorable conditions for a disappearance of the organic matter.

Applying these facts, we can say that for purifying the sewage discharged into a river oxidation can be depended upon only to a limited extent, because of the comparative slowness with which it takes place. Subsidence of the heavier matter tends to clarify it before it flows many miles; dilution with a sufficient quantity of clean water prevents an offensiveness almost at once; but oxidation equires many days under continuous aeration of the river

Therefore, by examining actual purification of polluted streams and realizing that oxidation is a comparatively small factor, we are furnished with some evidence as to the proper dilution of sewage in the case under consideration, which cannot be far wrong, and may serve a useful purpose until more information is obtained.

The data which are now available are not many, because opportunities to establish the same on a large scale, which alone is of practical value, have seldom offered.

In our country instances are the Desplaines and Illinois Rivers, receiving the sewage of Chicago; the Blackstone River in Massachusetts with the sewage of Worcester; and the Merrimac River in Massachusetts with the sewage of Lowell and Lawrence. In Europe the most instructive case is the River Seine below Pari time when it received all the sewage from that city Paris, at the rivers are the Irwell, Mersey, and Darwen in England, and the Oder, Isar, and Elbe in Germany.

It would be tedious to descrize to you in detail the changes taking place in each case, and I will confine myself to some general remarks. Profiles were platted of some of these streams, showing their general descent, 10 indicate their relative facilities for oxidation, also the average dry weather flow at all points, gradually augmented by the affluents. The results of the chemical analyses were platted at the respective points.

It was clearly shown how the increased dilution lowered the percentages of albuminoid and free ammonia almost

& Chem. Central Blatt, 1885, P. 333. igitized by

^{*} Read at the Annual Meeting of the American Public Health Association, at Memphis, November 10, 1887, by Rudolph Hering,

See Report Philadelphia Water Department, 1888.

^{*} English sewage is from 2 to 3 times less dilute than American

^{*} According to Dr. Konig (" Pollution of Water-Courses." Berlin 1887) the minimum quantity of organic matter which can be detected by chemical means is 1 milligram in a dilution of 1:1,000,000; of ammonia 0.05 milligram in a dilution of t: 20,000,000. Chloring can be detected as o. 1 milligram in a dilution of 1: 10,000,000.

⁺ Sixth Report, 1879. p. 176.

^{\$} Proc. Inst. C. E., Vol. 88, p. 215.

in exact proportion to the increase of dilution, and that the

in exact proportion to the increase of cliution, and that the apparent purification, which was often supposed to be due to oxidation, was due mostly to greater dilution.

The sewage of Chicago, mixed in a proportion of about one of sewage to four of lake water, or of 60 cubic feet per minute per 1,000 persons, is pumped into a canal and flows, without further increased dilution, for nearly thirty the incompany hours, and its condition, which is flows, without further increased dilution, for nearly thirty miles in about as many hours, and its condition, which is quite offensive, is not changed very much. Then it descends over several dams, mingles with the water of Desplaines River, and within a few miles it is visibly improved. When, forty-five miles below Chicago, it unites with the water of the Kankakee and forms the Illinois River, the water causes a dilution twice as great as that in the canal, and the river loses its offensiveness during the the canal, and the river loses its offensiveness during the greater part of the year. At Peoria, 158 miles below Chicago, the sewage has a dilution of nearly three times Chicago, the sewage has a dilution of nearly three times that in the canal, and, except when ice has covered the stream for some time, no odor can be detected, and the water is even partly used for the city's supply. Here there is a flow of 170 cubic feet per minute for every 1,000 ersons draining into it.

persons draining into it.

Owing to the fact that the velocity in the canal is greater than that in the rivers at its two ends, deposits are formed in the Chicago River before entering the canal, and again in the Desplaines River after leaving it.

I will say that the analyses upon which these deductions are based were made under the direction of Dr. John Rauch, Secretary of the State Board of Health of Illinois, and that the conclusion that in winter t80 cubic feet of water per minute per 1,000 persons draining at Chicago would be sufficient to prevent objectionable conditions all search the river, is originally his. along the river, is originally his.

The Blackstone River, in Massachusetts, which is quite foul below Worcester and receives much additional sewage on its way, becomes unobjectionable at ordinary times for all but potable purposes, about 15 miles below the city,* with a dilution at the rate of 140 cubic feet per 1,000 persons draining into it, together with considerable manufacturing refuse, and after there has been a chance for complete subsidence and some oxidation due to a large number of dame. ber of dams.

In Paris the sewage of nearly 2,000,000 people was turned into the River Seine before the irrigation fields were turned into the River Seine before the irrigation helds were put in operation. The organic matter in this sewage per inhabitant is, from the analysis, hardly one-half that of our sewage, because excrementitious matter was almost wholly excluded from the sewers. The dilution which rendered the polluted river entirely inoffensive in summer was 60 cubic feet per 1,000 people after a flow of 14 miles and after subsidence of the suspended matter had taken

If we reduce the recommendations of Dr. Miller and others for England as mentioned above, to our measures, we find that they believe a dilution of say 120 cubic feet of water per minute for 1,000 persons to be sufficient to guard against offensiveness. But this recommendation probably

against offensiveness. But this recommendation probably applies to small cities not devoted to manufacturing. By comparing these results and also those of the other rivers mentioned we can observe much similarity and consistency, and, for the present, we may draw the following inference: Rivers not to be used for water-supplies, but to be inoffensive to communities residing a few miles below to remain for for ordinary manufacturing purposes. low, to remain fit for ordinary manufacturing purposes, and to sustain the life of fish may receive the sewage from 1,000 persons for at least every 150 to 200 cubic feet of minimum flow per minute, supposing that natural sub-sidence of the heavier matter takes place immediately below

the town discharging the sewage.

Where for some reasons it is necessary to dilute it at once so that it is quite inoffensive before subsidence, which cases are rare, a somewhat greater dilution may be required. Inasmuch as the flow governing the minimum dilution occurs in summer no attention need usually be paid to the larger dilutions required in winter, because the natural flow of the water is much greater at such time.

Beyond the above limit it appears to be advisable when Beyond the above limit it appears to be advisable when arranging for a sewage disposal to resort to its purification at once by land or other filtration, or by chemical precipitation, in order to prevent the river-water from becoming objectionable to others. It is to be hoped, however, that more investigations will be made on this subject so that the limits which sometimes may be very important from the limits, which sometimes may be very important from an engineering and financial point of view, can be more

While the above figures may be a useful guide in many instances, yet they are but empirical formulæ, to be used only by those who thoroughly understand the subject, and to be applied only in cases similar to those from which they were deduced.

CAR-HEATING BY HOT AIR.

H. ASHMEAD, Civil Engineer of the Allegheny Valley Railroad Company, is said to have patented a device for warming trains by indirect radiation from a steam coil attached to the locomotive from which the hot air is forced through suitable ducts to the different cars. With this arrangement all danger, even of being too warm, is avoided.

THE PROPOSED NATIONAL BUREAU OF HAR-BORS AND WATERWAYS.

In response to our invitation for an expression of views, we have received the following additional letters for publication .

> DEPARTMENT OF PUBLIC WORKS, COMMISSIONER'S OFFICE, 31 CHAMBERS ST., NEW YORK, March 6, 1888.

SIR: I received your letter of the 15th ult. in regard to a bill for a "National Bureau for Harbors and Rivers." I have been a good deal indisposed since the date of the receipt of your letter, and when I was at the office there was an increased pressure of work which has delayed my reply.

I have not read the bill you speak of, but, without reading it, I think I can make a few practical suggestions.

In the first place, as regards a "National Bureau for Rivers and Harbors," that the Government already has. The Bureau of Engineers in Washington has been in charge of that business since the Government has undertaken the task of the improvement of rivers and harbors. If any improvements are necessary it seems to me that these could be easily grafted upon an institution already existing. If it should be attempted to found a new bureau, of necessity it would be composed of a large body of engineers to be educated in duties which are new to most of the profession, and a necessity of throwing aside and neglecting the experience and information already possessed by the Corps of Engineers.

It would be found that it would take a long time and a costly experience founded on repeated mistakes before the new bureau would be efficiently managed.

These are the ideas that occur to me as almost selfevident, and within the observation of any one who will give the subject a little consideration.

Respectfully yours,

JOHN NEWTON, Commissioner of Public Works.

CHICAGO, ILL., March 5, 1888.

SIR: I have seen few points in the criticism thus far that will not answer themselves by a close study of the bill. Several suggestions have been made publicly and by correspondents with a view to making its provisions clearer. Most of them, however, pertain to rules and regulations, and come within the province of the details which these are intended to cover.

The principal difference of opinion seems to be in regard to the matter of promotions. The bill aims to take middle ground between a military and civil system, as at present practicable. Whatever the final result of all the discussion indicates as wise and adapted to a large organization will be advocated by this board.

The report of the Executive Board of the Council of Engineering Societies on National Public Works will, I think, clear up the matter and justify the purposes for which the bill was drawn.

I am surprised that men should say that the number of the personnel and the cost thereof will be increased. In the comparison by Major Ernst the cost of the supervisory force only is given, while in the bill is included the technical working force as well. The total numbers less than have been employed on some river and harbor bills.

L. E. COOLEY. Yours very respectfully,

NEW YORK, March 7, 1888.

SIR: I have read Senator Cullom's bill in reference to the establishment of a National Bureau of Harbors and Waterways, but I do not see that much would be gained by it either for the service or for civilian engineers, for the proposed organization is too much in the form of a closed corporation to admit of much vitality and progress, excepting through the inherent spirit and ambition of the members which would compose it, and it soon would be the old organization under a new name.

The spirit of the institutions of the country is against the establishment of elaborate Government bureaus which would naturally drift in political channels if taken out of the hands of the military or naval departments. I would rather see the establishment of a National Bureau of Public Works as part of the Interior Department, and including in its scope all national engineering works, excepting those of a purely military or naval character, but deting those of a purely military or naval character, but determining only on the necessary works and on specifications as to the results intended to be accomplished and then letting private competition and enterprise turnish the plans and the execution.

Respectfully. ALBERT LUCIUS.

University of Pennsylvania PHILADELPHIA, March 2, 1888.

SIR: In compliance with your request to have me express my opinion upon the provisions of the bill now pending in Congress, proposing to reorganize the public civil works, I beg leave to represent that I believe all parties are agreed as to the desirability of a change. Whatever differences of opinion exist are based upon the manner in which it may be brought about.

As I have already expressed myself rather fully upon the subject of a reorganization, and as the provisions of the present bill embody many of the ideas so generally entertained and accepted, I cannot do better than to refer to my article published in Lippincoit's Magazine for October, 1837, showing the incongruity of the present system, pointing out some of its prominent defects and suggesting certain remedies.

In comparing these requirements thus suggested with the bill in question it will be seen that provision is made for some, but not all, of the important elements. The notable omissions are for ridding the corps of worthless timber and for creating emulation. The first defect may be supplied by the rules and regulations intended to be formulated by the Commission, but the second is not so readily adjusted. The corps will consist of over 600 members and promotion above a low grade is by seniority. Thus each man must pass along single file and, after once falling into line, there is no use in being in a hurry, for those ahead will have the choice of seats. But the line is so long that the chances are that in an ordinary lifetime the "cadet" will not pass the rank and pay of an "assistant." What inducement, then, for an energetic man to enter the service? In the present Corps of U.S. Engineers it has required about fifteen years to reach the grade of captain, and about twenty-one years to reach that of major, under very favorable conditions, but if the number beincreased tenfold the prospects for a living compensation are poor indeed. My opinion on this point is that promotion should be based upon relative ability and not upon a military succession.

In all development there must be at times a temporary derangement incidental to the introduction of new and enlarged working parts of the system, and it would be evidence of depreciation if such conditions did not exist at times in our body politic. Hence I am not of those who see only disaster in any modification of the existing regime, nor, concerning the personnel, do I think that it would be a change merely from the experience of years of service to the ignorance of amateurs. The men to whom the door would be opened are also tried and experienced in these very works, many of which have been designed by them in the capacity of civil assistants, and I believe that unless the Government will establish a special technical school for the education of men having charge of her extensive public civil works, as is done in foreign countries, that she must make it possible for the graduate of the many excellent scientific schools and universities of this country to enter her service, with the expectation of remaining in it during life. As an alumnus of the Class of '67 of the U. S. Military Academy, and as an instructor in a civil institution for over fifteen years, I would say that it is not possible to arrange a curriculum which shall in four years take a youth of average intelligence from the ordinary walks of life and properly prepare him for the rigid and high attainments of both the civil and military professions.

There is another element for which provision should be made in the bill, and that is the financial or administrative duties of the corps. These do not belong to engineering, and should be kept separate therefrom to avoid, as now, the serious encroachments upon the officer's time to the detriment of his work. Much more effective results will be obtained by permitting him to save by judicious designing and expenditure than by requiring him to employ some one else for this purpose, whilst he examines details of accounts "in triplicate" (?) to see that they are all straight." This would involve an accounting bureau similar to that of every large establishment or corporation-More might be said, but I forbear.

Very respectfully yours, LEWIS M. HAUPT.

A PROPOSED SOUTH AFRICAN RAILROAD.

It is reported from Natal, South Africa, that the Council there is considering the advisability of ceding a portion of its revenue from customs to any inland State which will carry forward the Natal Railroad from the border.

Digitized by GOGIC

This was the case at the time the analyses were made, some 12

MOVING THE HOTEL BRIGHTON.

It is said that south of the Coney Island shore a bar is being formed, westwardly, at the rate of about 700 feet a year, and that in consequence the shore just beyond its head is being greatly invaded by the waves; be this as it may, the sea is rapidly encroaching on Brighton Beach, and the high-water line has advanced so far inland as to cut into nearly equal parts the ground occupied by the Brighton Beach Hotel, and necessitate prompt measures for its security.

The hotel is an irregular wooden structure, covering a space, inclusive of the wide piazzas and projecting rear wings, of about 70.000 square feet, with 460 feet front and over 200 feet maximum depth. The main part of the structure has a sea front of about 420 feet and depth of 60 feet, exclusive of piazzas, and is three stories in height, besides basement and attic, with four towers each one story higher.

The hotel is supported on wooden columns, about 20 feet apart each way, carried up through the basement to the transverse girders under the first floor; the columns stand on small brick piers built on timbers bedded in the sand.

The ground is a fine, compact white sand, nearly level behind the hotel, but sloping from a height of about 6 feet below the first floor at the rear of the building to 18 feet at the front line, although before the recent washout it must have been much more nearly level.

A thin face wall of brick enclosed the basement and formed an apparent support for the building, but in reality carried no weight except that of the piazza. The sea has torn down all the front and much of the sides of this wall, and attacked the column piers, causing irregular settlements of as much as ten inches in some places, destroying plaster and decorations in the upper stories and doing other damage.

It was determined to move the whole building and its wings, extensions, etc., bodily 595 feet straight back from the sea and there re-establish it on piles sunk in groups of three each, to a depth of 15 feet in the sand and capped with IOX12 inch transverse stringers on which will be placed the original columns, supporting the building as at first.

In preparing for the move extra sills have been placed where requisite under the wing walls and openings made in the rear walls to admit 24 lines of standard gauge railroad track which have been placed close alongside the transverse rows of columns. The seaward ends of the tracks are carried on stringers supported by 1,200 piles set 8 feet deep in the sand, and having an aggregate transverse area 50 per cent. greater than that of the pier foundations under the old columns. These piles have been sunk entirely by the use of a 1½-inch jet of water at 60 pounds pressure, washing the sand from beneath the pile as it is lowered. Those for the new foundations will be similarly managed.

Continuous lines of flat cars, extending from front to rear of the hotel, are run under it on each of the twenty-four tracks, and carry, close to every longitudinal row of columns and on each side of them 12x24-inch longitudinal stringers, 21 and 42 feet long, resting transversely in two and three cars respectively, and breaking joints. It will, of course, be understood that the long way of the hotel is parallel to the beach, and that the tracks are at right angles therewith, so that the stringers longitudinal to the hotel span two or three tracks each.

The transverse girders of the building hvae joints on top of every column. Every section of the transverse girders is shored up at the ends by vertical posts set on hydraulic jacks, which are pumped until all the weight is removed from the old columns. These are then removed, and the jacks slightly depressed until the transverse girders rest on the longitudinal stringers, and are supported through them by the cars. As soon as the entire building is thus loaded on the cars, it is proposed to plant twelve anchorages at suitable distances in the direction of removal, and attach triple-sheaved sets of blocks and tackle to them, and the front cars on alternate tracks. The hauling lines will be led in symmetrical pairs to two locomotives, which will be placed on the eleventh and fourteenth track, and each reinforced by three other locomotives coupled in front. These are expected to pull evenly and unitedly, and easily move the 3,600-ton buildlng without racking, cramping, or injuring it further than to crack the plastering, which is already nearly destroyed.

The flat cars are not braced nor secured to the building in any way, except by the imposed weight. A rope will be stretched across the 24 tracks as near the front of the cars as possible, and fastened to each train.

The raising, moving and placing on new foundations is done by Contractors B. C. Miller & Son, of Brooklyn, N. Y., and the remainder of the work by the Brooklyn, Flatbush and Coney Island Railroad Company, who own the property, and whose superintendent, Mr. J. L. Morrow, is the engineer in charge of the work, assisted at the site by Architect W. J. Farquhar and his principal assistant, Theodore Melius.

Nearly 100 men are now employed, and one 90-ton and four 60-ton hydraulic jacks are in use, and about 120 flat cars are required. Mr. Farquhar estimates the approximate total expenses, inclusive of grading, repairing and redecorating, together with some new buildings and improvements, at \$100,000.

THE HIGHLAND BRIDGE.

WHEN the construction of the Poughkeepsie Bridge was commenced a good deal was said about a bridge to cross the river near Peekskill, but the former was vigorously pushed on while the latter was not heard from. Within a short time, however, it has been announced that the scheme has been revived, the matter put in definite shape, the engineers sent out to survey the site and stake out the work. The scheme was first brought up nearly twenly vears ago by General E. W. Serrell, who is acting as engineer for the new company. The bridge, which is known as the Highland Bridge, will cross the Hudson with a single span of 1,680 feet from Anthony's Nose to Fort Clinton, just above Peekskill, the river at this point being sufficiently narrow to permit of a suspension bridge spanning from shore to shore, while the topography of the country is of such character as to obviate the necessity of long shore spans or trestle approaches. The whole length of the bridge will be about 2,500 feet, from the water to the rails 195 feet, and to the top of the towers 320 feet. It is not decided whether wire cables or link and pin suspension chains will be used. The construction is estimated to occupy two years. The towers will be of steel. There will be a double-track railroad and a 17 foot roadway. In general appearance it will somewhat resemble the great New York and Brooklyn Bridge. The direct railroad communication will be with the New York, Lake Erie and Western Railroad on the west, and the New York and Northern on the east, the latter giving access to the elevated railroads of New York. There will also be connections with the important roads of New England, and on the west side of the river.

A FIRE-PROOF THEATRE CURTAIN.

In a letter to the Royal Institute of British Architects Mr. W. Heath thus describes a fire-proof theatre curtain of his invention:

"Below the stage (or the mezzanine floor, where an orchestra door exists) a curtain of very strong but absorbent material, preferably asbestos cloth quilted on strong canwas, is rolled on a roller over a narrow tank of water, the width of the roller, and in unrolling it passes under another roller at the bottom of this tank, thus rising perfectly saturated. Its upper edge is laced to a light iron girder extending 30 inches on each side beyond the proscenium opening. At each end of this girder flat iron chains pass upwards and over pulley-wheels of large diameter, their extremities terminating in a counter-balance weight slightly in excess of the weight of the curtain and girder, and this is the only motive power. The curtain is wound around the roller by simple winch and gearing, thus raising the counter-balance weight, which, if possible, is placed outside the building. Where this cannot be done it is placed in a corner and cased in. A simple catch retains the curtain in its position below the stage. The instant this catch is released, either by hand or automatically, the counter-weight descends, and the curtain rises thoroughly saturated with water. As soon as the girder reaches the top of the proscenium opening it engages two cams which are attached to the upper ends of two strong iron flanges, which immediately close on the curtain and grip it tightly against the back of the proscenium wall, entirely excluding smoke and flame. At the same time an equilibrium-valve is opened, by contact with the girder, and water admitted to the horizontal perforated main over the top of the curtain, thus interposing a wall of water between it and the fire.

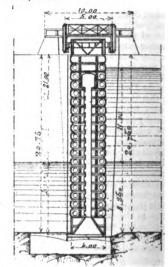
"As it would not be possible, without great expense, to test this against fire in an actual theatre, a model of the stage of a theatre, about nine feet in height by seven in width, has been constructed of strong iron plate on three sides, and the fourth (being the proscenium opening) is inclosed by the curtain. The stage is one-eighth the size of Drury Lane Theatre's, and the contents are 100 cubic feet. It has been filled with fuel, and a fire of great intensity has been maintained for more than an hour. The iron structure has become red-hot and distorted, while the curtain remained uninjured."

PROPOSED LOCKS FOR THE PANAMA CANAL

M. DE NANSOUTY describes in Le Genie Civil the essential points of the mechanism designed and contracted for by M. Eiffel to operate the great locks necessitated by the high-level modification of the Panama Canal.

As we have previously explained, this lock system is represented as merely a temporary device to permit a speedier utilization of the canal while the higher portions are being dredged to sea level.

There are to be two locks of 8m. (26.25 feet) rise and two of 11m. (36.09 feet) rise on the Atlantic side, and one of 8m. and three of 11m. rise on the Pacific side, each having an effective length of 18om. (590.58 feet) and gates 18m. (59.06 feet) wide.



TRANSVERSE SECTION AT GATE
FIG. 3

The ordinary double-leaved revolving lock-gates, introduced by Leonard de Ninci and now constructed at the Liverpool Channel Docks up to 40 feet in height, are wholly impracticable here, where they would fail both in durability and requisite ease and rapidity of action, which must indeed be almost continuous.

Long flights of low locks are far too tedious. The patent system of M. Knipple has therefore been adopted. It is especially adapted for dry docks and similar basins whose gates require to be rapidly opened and closed, and has been used since 1874 at the dock at New Gravel Greenock, and in docks at Montevideo and in English Columbia. It is essentially a floating rectangular metallic

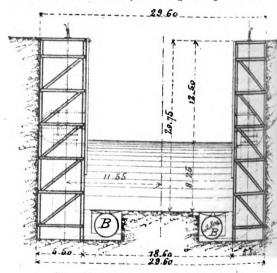


FIG. 4. SECTION ON A-B
PANAMA CANAL

caisson that recedes into a recess perpendicular to the side wall of the dock. It is divided into two water-tight chambers by a horizontal partition near the lower water-level. The lower chamber contains sufficient air to nearly buoy up the weight, and valves admit or discharge water from the upper part so as to regulate the equilibrium. This caisson slides on the bottom and is guided at the upper part.

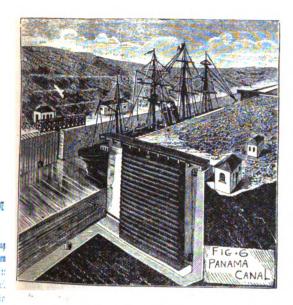
The Panama system as modified and projected by MM. Eiffel and Ph. Bunare-Varilla is as follows:

The caissons are carried by trucks rolling on a track that is supported over the recess or side pocket by a fixed

Digitized by GOGIC

iron frame of transverse girders and bracing, and over the opening of the lock by a counterweighted iron swing-bridge 5.5m. (18.05 feet) wide, with arms 23.8m. (78.09 feet) and 10.4m. (34.12 feet) long. After the caisson has been drawn into its recess the bridge is swung through 90° into a position on the canal bank parallel to its axis, leaving the opening clear for the passage of vessels.

The gates or movable caissons will be rectangular boxes stiffened by internal horizontal girders Im. (3.28 feet) apart vertically, and will be divided into a lower working chamber and nine upper chambers by horizontal and vertical partitions. Each chamber will have valves and connected into for filling it with water or compressed air at will, and the lower or working chamber will be arranged to libe utilized for a pneumatic caisson for laying the foundation of the pivot pier of the swinging bridge. Each caisson will be hung from the track above by links that will permit some vertical movement and some tranverse play on the rails.



For an IIm. lock the tail gate will be 21.6m. (70.87 feet) long, 4m. (13.12 feet) wide, and 21m. (68.90 feet) high, and the head gate 21.6m. long, 3m. (9.84 feet) wide, and Iom. (32.81 feet) high; for an 8m. lock the height only of the gates will vary.

The clear opening will be 18.6m. (61 feet) wide at bottom and 20.6m. (67.58 feet) wide at top.

The locks will be cut in solid rock, which, with a slight sheathing for a fender-guard, will form the side wall. The side walls immediately below the gates will be made with iron frames filled with concrete and faced with cast iron. The dimensions of this portion will vary with the size of the lock. For an IIm. (36.I feet) lock they will be 30m. (98.4 feet) long, 24.25m. (79.6 feet) high, and 5.5m. (18.05 feet) thick.

The chambers for receiving the gates when opened will be 7m. (22.96 feet) wide and 30m. (98.4 feet) long, covered by a permanent floor.

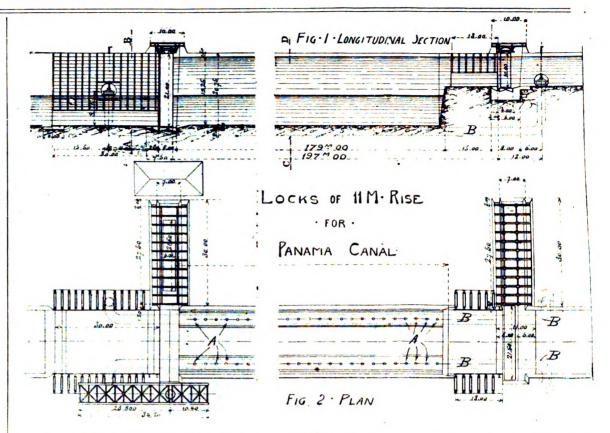
The gates and swing-bridge will be moved by chains leading to drums driven by turbines, using water from the head-level. Hand-gear will also be provided for emergencies.

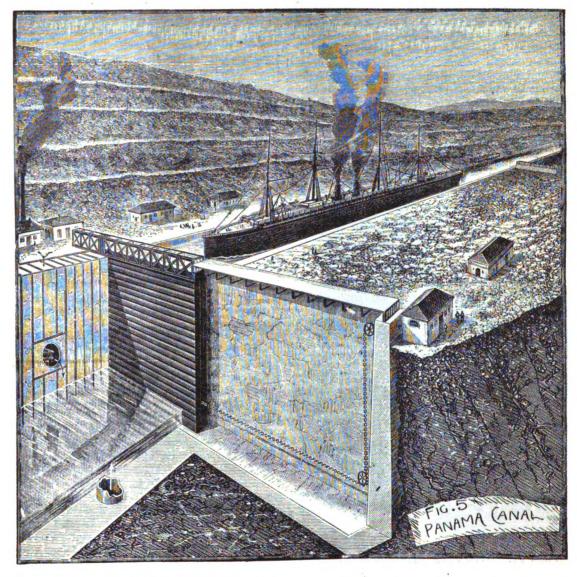
The reception or discharge of 40,000 cu. m. (1,412,420 cubic feet) of water in fifteen minutes is to be accomplished without violent currents by a system of longitudinal pipes (B B, Figs. I and 2), one each side of the lock, which will have holes (A A, Figs. I and 2) 0.4m. (1.31 feet) in diameter and 2m. (6.56 feet) apart to discharge or receive the water. The longitudinal pipes are 2.8m (6.82 feet) diameter and extend 15m. (49.2 feet) above and 12m. (39.4 feet) below the lock, where each terminates in a vertical section 9.75m. (32 feet) high, and provided with a valve at the top set in a chamber in the iron-faced portion of the canal wall.

The construction of this system of locks will require about 15,000 tons of wrought and 20,000 tons of cast iron, and it is specified in the contract that French materials must be used.

THE MEXICAN INTERNATIONAL RAILROAD.

A DESPATCH to the New York Times from the city of Mexico states that the International Railway was opened for business March 1. It runs through rich mineral and agricultural country from Piedras Negras, opposite Eagle





Pass, Texas, to Torreon, on the line of the Mexican Central Railway. It was built by C. P. Huntington and associates without a dollar of subsidy from the Mexican Government. It is practically part of the Southern Pacific system. It is a substantially-built broad-gauge road, and is equipped with Pullman buffet cars.

Only one change of cars is necessary between the city of Mexico and New Orleans or Washington or New York or other American cities. The road shortens the time to the United States by 24 hours, and reduces the distance to New York or Washington 553 miles. The road passes through the coal deposits in north-western Mexico acquired by Mr. Huntington some years ago,

A PROPOSED INTER-LAKE CANAL.

A DISPATCH to the New York Times states that New York and Minneapolis capitalists propose to construct a canal connecting the head of Big Bay De Noc, in Lake Michigan, with South Bay, in Lake Superior. The distance is forty miles, and it will save about 300 miles by water. The estimated cost of the canal is \$5,000,000, and competent engineers are said to have pronounced the project perfectly feasible. It seems probable that work will be begun as soon as the necessary capital can be secured.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas Light Company.
						<u> </u>	
March 3	24.53	19.57	20.95	29:75	28 21	22.38	28.91

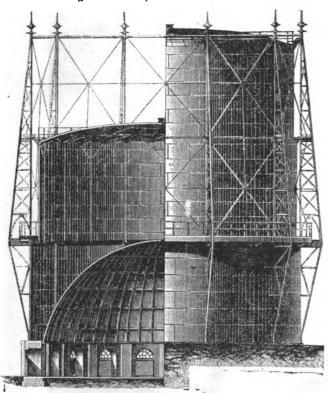
SPEAKING of the half-yearly meeting of the South Metropolitan Gas Co., held on the 22d inst., Mr. George Livesey, the Chairman. expressed regret that the amalgamation scheme proposed to the Gas-Light and Coke Co. had not been carried out, and gave his opinion that under such an amalgamation the price of gas over London would be reduced to 2s. 5d. (58c.) per 1,000 cubic feet. He strongly objected to the continuance of the coal dues, and said that their abolition would at once reduce the price of gas 1d. (2c.) per 1,000. The company obtained 7s. 1d. (\$1.78) per ton for their residual products last year, as against 6s. 3d. (\$1.50) the previous.

AN ABOVE-GROUND GAS-HOLDER.

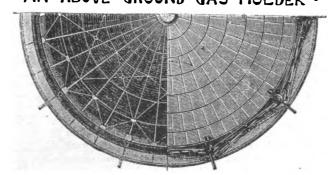
A GAS-HOLDER, constructed by M. A. Klonne for structures where foundations must be shallow and the soil is not compact, is thus described in the *Revue Industrielle*.

The tank is hemispherical in the bottom, and is supported on a solid structure of double T-iron. The holder is made with heavy channel or angle iron curbs at top and bottom, with vertical stiffeners of the same. The holder is guided between ten latticed radial columns of double T-section by automatically-adjustable rollers.

The columns are connected by two strong polygonal horizontal systems of channel-iron braces, with vertical, horizontal, and diagonal ties of round iron, and are further stiffened by a heavy gallery around the top of the tank. The figure represents a gasometer of 65.61 feet diameter and 78.74 feet lift, with a capacity of 266,000 cubic feet. A single section may be first built, as shown in the vertical



· AN ABOVE-GROUND GAS HOLDER



section, and a telescopic section added when necessary, as shown in the partial elevation.

The advantages claimed for the hemispherical tank bottom are: ready access to all parts, the easy detection and stoppage of any leak, the smaller quantity of water required, and consequent diminished pressure on the bottom, rapidity of filling and emptying the tank, large decrease of load on the foundations and underlying soil, and advantage of space gained under the concavity which makes a desirable storehouse.

Some of these claims are valid, but it looks as if the gain of diminished total weight was largely counterbalanced by the concentration of the whole load on the outer wall and its foundation and that the construction of this hemispherical surface, and its special foundations would be very much more costly than the usual arrangement and only defensible in special and exceptional circumstances.

IS ELECTRIC WELDING RELIABLE? LYNN, February 9, 1888.

SIR: My attention has been called to a brief notice in a late number of your journal, under the caption "Is Electric Welding Reliable?" the tendency of which is toward doubt in relation to the strength of electrically welded joints; and whilst I think the criticisms made on the results of the action of the electric arc, which has been used in St. Petersburg and Paris for a so-called electric welding, but which is more truly an electric burning together of the metals, may be and probably are correct, yet I can say most positively that in relation to the results of the electric welding process devised by me, and in which the current heats the metal without the intervention of the arc or a flame, experiments have shown that the results obtained in iron and steel are much superior to ordinary blacksmith work, and that butt welds by my process are stronger than the regular lap welds of the blacksmith.

The heating of the pieces of metal under perfect control can be kept within any desired limits, or maintained at that temperature which will weld without burning the material, and as a consequence of this, my process is applicable to the welding of most of the metals.

In the arc method a temperature far beyond the softening or melting temperature is unavoidably present. Some metals undergo a partial volatilization, the tendency of this being to boil out the occluded gases and to make the metal spongy, while by my method a temperature of sufficient softening to cause union if gradually reached, and either a low or a high temperature can be steadily maintained.

It will readily be seen from what has been said that the process I use, when applied to iron or steel, can result in no other action on a material than would have resulted had the pieces been heated with a forge fire or a flame; besides, in my process there are the advantages of a far more perfect control of temperature, and consequent rapidity and accuracy of work.

A full series of tests of the tensile strength of electric welds in iron, copper, steel, brass, etc., have been made at the U. S. Government Arsenal at Watertown, with butt welds hammered and unhammered and variously treated, and these tests have been compared with tests made of lap or scarf welds made by the blacksmith process. The result has been greatly in favor of electric welding, the welds showing much greater strength and homogeneity. Tests by bending have shown that there is an almost complete union of the metals, a homogeneous welding having taken place. The ordinary mechanical tests by twisting, bending, etc., have proven the strength of the welds, and given me great confidence that the process will reach a large industrial development in the near future.

Yours very truly, ELIHU THOMSON.

BRILLIANT IGNORANCE.

THE Journal of Gas-Lighting says: "The remarkable freedom of newspaper writers from knowledge of the subjects upon which they compose their brilliant leading articles is at length beginning to irritate the electricians. An electrical journal falls foul of the Morning Post for publishing a mass of nonsense about the difficulty of adapting electric-lighting to ordinary household use. In the course of it the wonderful idea was promulgated that in years to come the prudent householder would 'store up against the winter his stock of electric accumulators, just as the Irish peasant builds his stack of turf.' Imagination fails to indicate to a reader possessed of the merest sprinkling of technical knowledge what manner of man must be that newspaper writer who, living sufficiently in the world to know electrical accumulators by name, yet finds it in him to mention these articles in the language cited above."

THE LINEFF ELECTRIC TRAMWAY.

A SHORT length of electric tramway on the Linefl system in operation in the depot of the West Metropoli. tan Tramway Company, Highroad, Chiswick, is thus described in London Engineering: The current is led to the car through a conductor laid in a tube or trench in the centre of the track. The copper strand or rod which car. ries the current is contained within an iron pipe carried in brackets bolted to the side of the trough. This tube is covered with insulating compound, and between it and each of the brackets there is interposed a layer of non-conducting material. About every four feet there occurs in the pipe a T-piece pointing upwards, and into each of these fittings there is screwed a plug which binds tightly against the copper conductor at the bottom, and at the top carries a trough-like head. This head serves to convey the current to a flexible contact piece carried by two grip. per arms which are fastened to the car and pass through a slot formed in the top of the trench. Between the arms there is loosely stretched a wire rope on which are threaded a number of gun-metal ferrules to give it weight. This rope lies in the trough-like heads of the plugs mentioned above, making contact with four or five of them at a time The current then flows up the gripper arms to the motor on the car. In the example shown, there is a current of ten amperes and 220 volts, and this drives an Immisch motor at 1,000 revolutions per minute, the motion being conveyed to the wheels by two Reynolds chains. The car is provided with an electric brake worked by a pair of solenoids and a horseshoe core. It has also a buffer boardateach end. If this board strikes an object on the track it is forced inwards, and in moving it operates a switch, which (1) cuts off the current from the motor and directs it into the brake magnet; (2) reverses the brushes on the motor; and (3) switches the current back into the motor. Thus the car is automatically reversed. The novelty lies in the method of carrying the conductor, and making contact between it

WATER-WASTE PREVENTION IN ENGLAND.

In connection with the water-supply of towns, there are few questions which are of such importance as the prevention of waste, and this must ere long be seriously taken up with reference to the supply of London from the Thames. It is not too much to say that fully one-third of the whole of the water taken from the Thames by the London water companies is wasted without direct or indirect advantage to any one. Without reducing the quantity of water used by the consumer, the waste at present occurring under the streets and from the use of bad sys tems of distribution, and bad fittings, might be effectively stopped by means of a waste-water detector system, with the inestimable advantage that for many years, if ever again, nothing would be heard of threatened shortness of the available water-supply of London, or of expenditure for new sources of supply. - The Engineer.

NEW ENGLAND WATER-WORKS ASSOCIATION.

The regular quarterly meeting of this association will be held at Young's Hotel, Boston, on Wednesday, March 14, 1888. The rooms will be open for members' use at 11 o'clock. At 2:20 o'clock Prof. William T. Sedgwick, of the Massachusetts Institute of Technology, will read a paper entitled "The Biological Examination of Water," and the discussion will be opened by Messrs. Dunham. Fitz Gerald, and Stearns. Members are invited to suggest for discussion at future meetings any topics which they may deem of interest to the association. Members of water boards are cordially invited to be present. Applications for membership will be considered, and for this purpose blanks may be obtained of the Secretary, who would be pleased to correspond with any parties desiring information on this point.

The seventh annual convention of this association will be held at Providence, R. I., on Wednesday, Thursday; Friday, June 13, 14, 15. The headquarters of the association will be at Narragansett Hotel. The Associate Members are invited to prepare for an exhibit of such supplies as they represent. Space for such a display will be provided by the Executive Committee. Edwin Darling. President; R. C. P. Coggeshall, Secretary, New Bedford, Mass.



Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

CONTROLLING THE DAMPERS AUTOMATICALLY IN A HOT-WATER APPARATUS.

BOSTON, MASS., February 28, 1888.

Boston, Mass., February 28, 1888.

SIR: We notice in your issue of February 18, 1888, an article from one of your readers entitled "Controlling the Dampers Automatically in a Hot-Water Apparatus," and your reply recommending the "Geyser" regulators sold by the E. H. Cook Co., Rochester, N. Y.

Now, we think we have something better and more simple adapted for the purpose of regulating a hot-water apparatus—that is to say a "hot-water indicator". It is

connected on a flow-pipe running from the heater by means of a 2x 1/2 inch tee, and since its introduction has been extensively used, and will be found useful in regulating an apparatus.

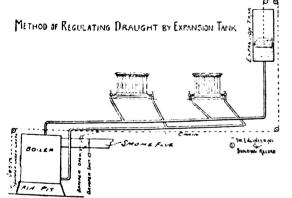
We are very truly yours.

GURNEY HOT-WATER HEATER CO.,

JOHN A. FISH, Managing Director,

[If our correspondent will again turn to the article in the issue of February 18, and read it carefully, he will notice we do not recommend the "Geyser" or any other heat-controlling apparatus. What we did say was that the parties named "have an apparatus that they claim will control the heat, etc.," and, further, "that we believe there were other contrivances for the same purpose, but we are not conversant with them." Had we known of your apparatus we would have mentioned it at the same time and in the same way. If these matters are called to our attention while they are novelties we will be very glad to illustrate them, that our readers may draw their own conclusions as to their merit. etc.]

BILLINGS, MONT., February 23, 1888. SIR: In answer to W. P. Powers' inquiry, in your last issue, in regard to an automatic device to govern dampers on hot-water apparatus, I respectfully send the inclosed cut that I think will explain itself to any good workman. I have used it with good success in my practice. The device, of course, is intended tor an open tank system, and



can be regulated for any temperature of water by adjusting chain. The float and damper should be counter-balanced. On the end of lever, attached to smoke-flue damper, there should be an iron or lead weight to close damper when float rises. Hoping this may be of some use to your readers, I am yours respectfully, A READER.

[Our correspondent's method is not unknown to many in the hot-water trade. For some reason, however, it has not received the recognition it would appear to command. Like almost everything else. it has a weak point, which is the trouble to keep the desired level in the expansion-tank. It cannot be used when a ball-cock is used, as the ballcock keeps a constant level unless it is submerged to operate only at a very low point; and when there is no automatic supply, unless the apparatus is absolutely tight, the variation in the tank destroys the regulation. In the hands of one who will look after the careful regulation of the height of the water it should give good results.]

TO PREVENT SYPHONAGE OF A TRAP.

OFFICE OF POST HOSPITAL, FORT SUPPLY, I. T., February 28, 1888. Sir: Will you please answer the following, either by letter or reference to THE ENGINEERING AND BUILDING RECORD, what prevents the water-seal of a water-closet outflow-pipe from being syphoned out by sudden rush of water?

Very respectfully,

P. BOLAND.

[To prevent syphoning it is only necessary to admit air to the top of the syphon, which destroys the vacuum. To do this in practice a bent pipe should be run from the highest point of the branch waste-pipe, between the trap seal and the main, either into the main waste-pipe at some higher point, or to some place where it can safely communicate with the outside air. The plumbing regulations of our leading cities have for a number of years required these vent-pipes? quired these vent-pipes.]

TO PREVENT RUST IN HEATING BOILERS DURING THE SUMMER.

WASHINGTON, D. C., December 27, 1888.

SIR. I notice in some of the trade circulars of firms engaged in steam and hot-water heating directions for preservation of the pipes and radiators, to, at close of winer's work, empty all the apparatus and then to fill again with fresh water.

with fresh water.

Is not this a mistake? Water itself, in absence of air, does not corrode iron. But living water, fresh from streams or springs, delivered through city pipes, has always a certain quantity of air, richer than atmospheric air in oxygen, absorbed by the water. It is this free oxygen which supports the life of fishes, and which supplies the oxygen to rust iron in contact with it. Boiling expels this air and oxygen, and the water which has remained unchanged for weeks in a steam or hot-water heater should be thoroughly free from air and free oxygen and the best be thoroughly free from air and free oxygen and the best fitted to prevent oxidation or rusting or corrosion of the

inside of iron boilers and pipes.

Does experience contradict this reasoning, which seems at least to be justified by the laws of chemistry?

Is it not safer to preserve in the apparatus the water long used and freed from air and free oxygen by repeated boiling?

M. C. MEIGS.

[It is a mistake to draw off the water from a heating apparatus in the spring and fill it with fresh water. The condensed water that remains over the winter with more or less oil, etc., in it should be let remain. It is more desirable, however, to fill the boiler to the stop-valve with water than to draw it off and leave it empty, and therefore when there is no condensed water to fill it with, fresh water has to be added. Draw all this water off in the fall, clean the boiler, and fill with fresh, clean water for the winter's use.]

HOW TO REMOVE IMPURITIES FROM SOLDER.

SCRANTON, PA., March 2, 1888.

SIR: Can you give me information regarding the treatment of solder to remove impurities? JOHN PURVIS.

Mr. Alfred Ivers, one of the oldest master plumbers of New York, explains as follows the method he has used with satisfactory results for many years. The solder is simply melted in any convenient amount and when it is all liquefieu a piece of sulphur is thrown in and causes the impurities to gather in a floating scum that is skimmed off and leaves the pure metal ready to be cast into cakes or bars for required use. A lump of sulphur the size of a hickory nut is sufficient to refine ten or fifteen pounds of solder. Some plumbers have a small ladle with the handle bent down instead of up, fill the cup with powdered charcoal, and force it, bottom side up, into the kettle of melted solder. When it reaches the bottom it expels the impurities which rise to the top and are skimmed off as before. Mr. Ivers says this method answers well, but that he uses and prefers the sulpher treatment.]

THE USE OF ANEMOMETERS.

TORONTO, February 24, 1888.

51R: I nave for some time used an anemometer in working out problems in ventilation, but do not feel satisfied that I obtain correct results on account of the way in which the correction for error is stated. The label inside the lid of the box reads: "Add 30 per minute to the observed reading of the air-meter." SIR: I have for some time used an anemometer in work-

Now, it appears to me that, as the error is due to fric-Now, it appears to me that, as the error is due to friction, it must be in the same ratio for every revolution of the wheels, so that the correction ought to be so much per cent. on the number of feet registered. Applying the rule as given, the result would be as follows (and looks absurd):

1000 + 30 = 1030, 01 3 per cent. 100 + 30 = 130, 01 30 " 10 + 30 = 40, 01 300 "

A letter to the makers only elicited the reply that the error is due to friction and that the correction is properly stated. I shall be obliged if you will kindly throw some light on the matter.

[We have had the same experience with a well-known make of anemometer as our correspondent, and could get no better answer from the New York dealer than he has received. That the amount of error should be constant per unit of time seemed hardly probable or at best merely an approximation. We were dissatisfied, therefore, with this uncertainty, and consequently, as a rule, test, at least approximately, any anemometer we have to use. Our method of test, though not without possible error, is reasonably reliable and always easily made, as no instrument but a tape line and a large closed room-the larger the better-is necessary. We measure a track around the room of 100 feet or any other convenient distance. Then holding the anemometer at arm's length on small rod at right angles to the way we face, we go

around the track in different directions and at different speeds, noting the error, whether fast or slow. By reversing the direction of motion about the track the effect of local currents in the room is eliminated and the danger of setting all the air in motion in one direction around the room is avoided. If an anemometer is held before the operator or near enough to his body so his motion will affect the air the anemometer is passing through the experiment will not be reliable. There are other methods, but they require special contrivances.1

"SKIN" PLUMBING IN NEW YORK AS DE-TECTED BY THE INSPECTORS OF THE BOARD OF HEALTH.

ON January 18, 1888, David Durie, Jr., and James H. McManus, of East One Hundred and Seventy-sixth Street, were arrested for violations of the health laws in the plumbing of twelve houses on One Hundred and Fifteenth Street. east of Sixth Avenue. Inspectors E. P. Eastwick and I. P. Corcoran reported many open joints, split hubs, hubs placed downwards, drain-pipes laid level, and joints with no lead. The Justice granted a delay of two weeks to permit rectification of the work. After a second two weeks the work was reinspected by the Health Department, and seven of the original violations were found remaining.

. The defendents were fined \$250 each, although they produced two plumbers at the trial who swore that the work was perfect.

January 5, John Foley, of 385 Second Avenue, was held for trial before Special Sessions for violations of Health Board rules in doing a piece of plumbing in addition to the work called for in the original job and for which no plan had been filed.

Inspector J. T. Corcoran found open joints, unvented traps, and open joint in main drain. Mr. Foley pleaded sickness that prevented his personal supervision of the work and was sentenced, January 20, to a fine of \$25.

Kirchof & Brown, 210 East Eighty-sixth Street, were held December 28, 1887, for violations in two houses, Nos. 38 and 40 Morton Street, where Inspector H. F. Barkley found a total number of 78 joints that were defective, open, strained, or packed with oakum only, some of which were covered by plastering.

They were tried before Court of General Sessions January 25, and fined \$25 each.

Frank M. Clemmens, 1507 Avenue A, who, as we recorded in our issue of December 31, was held for violations in house No. 93 East Eighty-fifth Street, was tried before Court of General Sessions February 8, and fined \$50, the particular charge being open and defective joints.

Several cases are still pending before the Court of General Sessions that have been delayed since before the above were commenced. Among them that of John Kelley, who was held December 3, as stated in our report of December 31, and Plumber Francis Callaghan, whose case dates back nearly five months.

The case of Herman Hoeffer, who was held December 13. 1887, for trial by Court of General Sessions for violations in the large apartment house at north-east corner of Fifty-fifth Street and Broadway, where the pipes were found plugged up to mislead the inspectors, is still in abeyance, notwithstanding its particular flagrance. The activity of the Health Board in the matter of these prosecutions is having a salutary effect and much less bad work is being reported by Chief John C. Collins and his inspectors.

HORSES' POWER AND HORSE-POWERS.

A PAIR of good horses can exert a pull of quite 1,300 pounds for a short distance. At a speed of only three miles an hour this amounts to ten indicated horse-power, and is actually often exerted, horses being able, for short periods, to put forth at least five times more than their normal power.

CAR-WHEELS made of paper, under hydraulic pressure have for some years past been on trial on some of the railways in Germany. Recent reports give instances of failure, and investigation has shown that in the majority of cases of failure and collapse of wheels the periphery of the wheels has been burst, owing probably to the action of the brakes. The wheels have lasted some years before

THE New York and Harlem Railroad Company has asked permission from the Board of Aldermen to use electric motors on the Fourth Avenue surface road in New York City. Digitized by GOOGLE

SOME DETAILS OF WATER-WORKS CON-STRUCTION

CUP-JOINT VERSUS WIPED-JOINT.

OUR readers will be interested in the following correspondence, which sufficiently explains itself, Mr. Kirk's letter to us having been sent to Mr. Billings for reply:

TORONTO, February 25, 1888.

SIR: In your paper of February 11, 1888, page 166, under the head of "Water-Works Construction," Mr. W. R. Billings, C. E., speaks disparagingly of the wiped-joint, and claims equal, if not greater, strength for what he terms the cup-joint. Now, I propose a fair question to Mr. Billings. Has he ever made a practical test of the strength of these two kinds of joints? that is, taking a tair sample of each; if so, what was the result of such test? In the making of both these kinds of joints it is necessary to open or widen the end of the pipe, and as a result the pipe is thinner than it formerly was; in the case of a wiped-joint the thin portion of the pipe has been covered well with solder, which is not the case with the cup-joint (as is shown in the cut on page 88, Vol. 17). The only argument in favor of the cup-joint is cheapness; it can be done by labor of inferior skill. Yours respectfully,

BENJAMIN KIRK.

TAUNTON, MASS., March 5, 1888.

SIR: I take pleasure in replying to Mr. Kirk's courteous note of February 25 by frankly admitting to begin with that I have not made any comparative tests of strength of the cup and the wiped joints, and furthermore, that if Mr. Kirk has records of any such tests I should esteen it a great favor to be allowed to see them. In the absence, then, of special tests one must base his opinion upon the experience of himself and others, and upon the special features of each joint as developed in a study of the structure of the two. I know that the cup-joint has been used in Boston, Mass., for many years, and has given satisfaction, and I know that it has been used in Taunton for two years without developing any signs of weakness, and that, too, under severe treatment. Now, if Mr. Kirk will make a full-size drawing of a longitudinal section of each joint he will agree with me, I think, in saying that the source of strength in each joint lies in the perfect union of the metals over the surfaces in contact, and that in the wiped joint there is an excess of solder. By way of illustration, though I admit the inexactness of the comparison, we may speak of the wiped joint as one in which the edges are butted together and held by a strap of solder, while the cup-joint is a lapped joint held by a perfect cement. I am told, moreover, by experienced plumbers that a wiped joint under changes of temperature, such as will occur in a hot-water pipe for example, will open at the edges, and when brass is connected with lead, the unequal expansion of the large mass of solder, the lead, and the brass, makes this statement seem more than probable.

brass, makes this statement seem more than probable.

Mr. Kirk says "the only argument in favor of the cupjoint is cheapness," and, properly understood and applied, this is argument enough. It is one of the commonplaces of engineering that we should obtain the maximum of useful effect with the minimum expenditure of material consistent with safety.

WILLIAM R. BILLINGS.

QUICKSAND IN THE SHORE SHAFT OF THE NEW CHICAGO WATER TUNNEL.*

(Special Correspondence from Chicago.)

ACTING CITY ENGINEER W. R. NORTHWAY says: " Having struck a very large pocket of quicksand containing limestone boulders, it is evidently impracticable to run the city's new water tunnel into the lake from that point. Mr. Onderdonk will sink a new shaft at some point in Lake Park to be determined by boring, and from this the lake tunnel will be projected. The old shaft was sunk some 77 feet-about its full projected depth-when this quicksand pocket of unusual extent was encountered, along with water, and though 500 gallons a minute were pumped out for a week or more, further progress on the shaft was inappreciable. The quicksand is so extremely fine that a magnifying glass scarcely shows the grains. It is so diluted that in a tumblerful left to settle, four-fifths is pure water above the sediment. A superficial depression has taken place along a strip between 200 and 300 feet wide, and extending from near Michigan Avenue east to the lake shore under the railroad tracks, the whole length perhaps 1,000 feet, with a depression in no place over two feet, despite newspaper sensations representing wrecked trains, collapsed houses, the disappearance of too yards of breakwater, and an earthquake havoc generally. At the same time it has been held really unsafe to go on. The limestone boulders, some of which had to be go on. The limestone boulders, some of which had to be blasted, were of various dimensions, from the size of your head to four feet in diameter, and they were often worn perfectly smooth. The water encountered does not rise head to four teet in chameter, and they note that apperfectly smooth. The water encountered does not rise in the shaft to within thirty feet of the lake surface, showing, of course, that they are not connected. The old shaft will be utilized for the land tunnel, and boring is already in progress to locate the new works, which will require three and a half years to finish. They will certainly be needed by that time."

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A REGULAR meeting was held Wednesday evening, March 7. Director Mendes Cohen presided over an unusually large attendance of members and visitors. The usual business routine was followed by the announcement of the decision of committees examining prize essays who awarded the Norman Medal to the paper on "Evaporation," presented by Desmond Fitz Gerald, M. Am. Soc. C. E., and the Roland Prize to the paper on "Steel, some of its properties, its use in structures and in heavy guns," by William Metcalf, M. Am. Soc. C. E. The Secretary then read a paper by John W. Hill, M. Am. Soc. C. E., on "Test of an Edison incandescent electric lighting plant." The paper was a description, report, and tabulation of an elaborate eight days' working test of the cost, efficiency, and relative value compared with gas of the Edison plant in the Union Central Depot at Cincinnati, O.

Very complete data were given of all the physical, mechanical, and electrical conditions and the detailed results secured. The lamps of 16 and 32 nominal candle-power were carefully tested by a voltameter, consisting of a bath containing two zinc plates through which a fixed proportion of the total current was passed, and caused a reduction in weight of one of the plates. This loss was assumed proportional to the current, and agreed satisfactorily with the galvanometer results, and accounted for 65 per cent. of the illumination.

It was stated that the cost of illumination increased directly with the age of the lamp and was about doubled after a few weeks, when the brilliancy was decreased in the same ratio. Variations of 20 per cent. to 30 per cent. in the intensity of illumination were observed while making the photometric tests. About 69 per cent. of the indicated horse-power of the engines was transmitted to the dynamos, of which 45.5 per cent. was utilized in actual illumination.

Mr. Hill found that, considering the actual illuminations compared, that of the electric lamps cost thirty-nine per cent. more than the gas-light. He considered that the results of the tests indicated so great a loss of power between the engines and dynamos, that electricians should be stimulated to remedy it.

After the conclusion of the paper it was discussed by J. F. Flagg, Mem. Am. Soc. C. E., and some explanations presented by Mr. Howell, who witnessed the tests as a representative of the Edison Company, who explained the low efficiency of the engines as due to an excessive amount of counter-shafting, and their working at one-eighth of their regular load; notwithstanding which the electric light was found ten per cent. cheaper than gas.

The results of the vote on amendments to the constitution showed that the proposed change establishing a student grade was lost by 137 affirmative to 142 negative.

The amendment providing for election of members by committee was lost by 67 affirmative to 212 negative.

The other proposed amendments relative to admission of foreign applicants and reconsideration of ballots were carried by votes of 251 and 226 affirmative to 32 and 55 negative respectively.

The meeting was then adjourned, and the members enjoyed the usual collation and social meeting.

The following gentlemen were elected:

As Members—Fred. James Amweg, Engineer in charge of Market Street Bridge over Schuylkill River for city of Philadeiphia; Oberlin Matthies Carter, in local charge of River and Harbor Improvements and Fortifications in Georgia and North-eastern Florida, Savannah, Ga.; Charles Sewall Gowen, Division Engineer, Division r, New York Aqueduct Commission, Sing Sing, N. Y.; Charles Davis Jameson, Consulting Engineer, New York City; Edward John Landor, Chief Engineer Wrought Iron Bridge Co., Canton, Ohio; Hunter McDonald, Assistant Engineer Nashville, Chattanooga and St. Louis Railway, New Market, Ala.; George Romaine Olney, Assistant Engineer Section 10, New Croton Aqueduct, Morris Dock, N. Y.; Francis Ensor Prendergast, Assistant Engineer New York and New England Railroad, Newton Highlands, Mass.; George Henry Robinson, in charge of Works at Marysville, Montana; Edward Wegmann, Jr., Division Engineer New Croton Aqueduct, Englewood, N. J.; Arthur Owen Wilson, conducting a general engineering office. Birmingham, Ala.; John Young, Engineer Geneseo Water-Works, Genesco, N. Y.

As Associate.—John Haines Warder, engaged at Edge Moor Iron Works inspecting Bridge Work and Material for the Balt more and Ohio, New York and New England, and Richmond and Danville Railroads, Wilmington, Del.

As Juniors—David Sylvanus Carll, Assistant Engineer Grand Avenue Cable Co., Kansas City, Vo.: Charles Alfred Hasbrouck, Assistant Engineer Detroit Bridge and Iron Works, Detroit, Mich.

PERSONAL

PROFESSOR BYRON W. CHEEVER, A. M., M. D., Professor of Metallurgy in the University of Michigan, died at his home at Ann Arbor, aged 46 years.

MR. L. L. BUCK, M. Am. Soc. C. E., has just returned to New York from the superintendence, at Pasco Junction, Wash. T., during the winter, of the construction of his recently, designed large combination bridge over the Columbia River for the Northern Pacific Railroad.

ARCHITECTURAL COMPETITIONS.

OFFICE OF
BOARD OF COUNTY COMMISSIONERS,
LANCASTER COUNTY,
LINCOLN, NEB., March 3, 1888.

Lincoln, Neb., March 3, 1888.

SIR: The architects' competition in the submission of plans for a court-house was awarded to F. M. Ellis, architect, of Omaha, Neb., being fourteen architects in the contest, from the following places: James Tyler, W. S. Gray, O. II. Placey and J. II. W. Hawkins, Lincoln, Neb.; F. M. Ellis, F. & C. Mendelson and Hodgson & Son, Omaha, Neb.; George F. Hammond, Cleveland, O.; Weary & Kreamer, Akron. O.; M. E. Beebe & Son, Buffalo, N. Y.; J. W. Yost, Columbus, O.; Schrage & Nichols, Kansas City, Mo.; Eche & Mann, St. Joseph, Mo. A fine lot of plans and hard to decide what plan to adopt, the building that was selected being 100x150, of stone, and fireproof.

Vours truly,
O. C. Bell, Clerk.

MISCELLANEOUS.

New York CITY.—At a meeting of the Aqueduct Commissioners held March 3 to award the contract for Section 16 of the New Aqueduct. Counsellor L. Laflin Kellogg and Arthur H. Smith, his associate, served an injunction on the Commissioners, and O'Brien & Clark, contractors, preventing the Board from awarding the contract to O'Brien & Clark, and restraining that firm from accepting it. The injunction, which is temporary, was granted by Judge Barrett in a suit brought by Jacob Ebling, a liquor dealer, as a taxpayer, setting forth the circumstances of the bidding and awarding, and alleging that the awarding is illegal and against public policy. He asks for a permanent injunction.

He asks for a permanent injunction.

The Commissioners have been notified to appear in Supreme Court Chambers Monday, March 12, and show cause why the injunction should not be made permanent. It is stated that in Section 16 there were several bidders. The proposals called for bids of three kinds:

(1) For the entire work; (2) for the iron-work;

(3) for excavating and laying pipes. O'Brien & Clark bid \$1,052,365 for the entire work—the lowest bid of that kind made. The Warren Foundry and Machine Company bid \$674,730 for the iron-work, the lowest bid of that kind. William E. Dean bid \$315,648.25 for excavating and laying pipes, the lowest bid of that kind. When the bids were opened O'Brien & Clark were decided to be the lowest bidders for the entire work in lump. Mr. Ebling asserts in his complaint that the bids of the Warren Foundry and Machine Company and Mr. Dean added together are \$61,937.75 less than O'Brien & Clark's bid for the same work, and that therefore they ought to have the contract. He alleges by the affidavit of Mr. Charles Jones, a contractor, that Mr. Dean and the Warren Foundry and Machine Company are honorable and pecunious contractors, who can be implicitly trusted to do their work honestly and well.

PHILADELPHIA, PA.—A Committee of Prison Inspectors opened bids on February 17 at the County Prison in Philadelphia for the construction of the outer stone wall of the new County prison, two portals, a guard-house, about 60 feet square and 45 feet high, and the rotunda from whence the cells will extend. The chamber of the rotunda will be 84 feet in all and 45 feet high, and there will be 1,800 linear feet of outer wall, which will be seven feet thick at the base, 3 feet 6 at the top, and 35 feet high.

The bidders were as follows: James J. Ryan. \$167,000; Charles McCall, \$165,500; T. H. Doan, \$137.233; Richard A. Malone, \$129,500; Frank Sweeny, \$169,000. The contract was awarded to Malone.

awarded to Malone.

NEW ORLEANS, LA.—Congress has received a report from Captain Black to the effect that

a report from Captain Black to the effect that it will cost \$50,000 to make a channel 200 feet wide and twenty feet deep through the two sandbars near Little Mangrove Point, so as to allow vessels to enter Tampa Bay. He also estimates that it will cost \$300,000 to properly improve the northwest channel near Key West.

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[•] The specifications for this work were abstracted and illustrated on page 620 of our issue of October 29, 1887.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



For works for which proposals are requested see also the "Proposal Column," pages 1-v1-v11-v111-236.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtain ing early and reliable news for our "Contracting littlegence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

ORANGE, N. J.—The Commissioners on Drainage, appointed by the courts some time ago to consider the condition of the Second River, Doddtown, have decided to recommend the widening and deepening of the stream.

CENTREVILLE, MD. — Water-works will probably be established here. Address the Town Clerk.

TECUMSEH, NEB.—Our correspondent writes as follows: "The water-works election held here was almost unanimous, there being only six votes against the proposition; \$21,000 bonds were voted. Bids will probably be opened March 29."

Kutztown, PA.—Concerning the water-works question here our correspondent writes as follows: "We have in contemplation to erect or establish water-works in our town. We had engineers here and had some proposals. The plan we have now in view is considered a very good one. I will inform you of what action will be taken at the next Council meeting.

ALEXANDER, ARK.—Concerning the report ALEXANDER, ARK.—Concerning the report that water-works were to be erected here the Clerk of Monroe County writes us as follows: "No water-works in contemplation in Monroe County, Ark., as far as my knowledge."

will be resumed about May I, to be completed in July; additional pipe-hydrants are likely to be required. R. B. C. Bement is the engineer in charge of construction; works owned by Superior Water Co., R.J. Wermyss, President, West Superior.

CLEVELAND, O.—The Secretary of War has transmitted to the House a report by Major Overman, for the Engineer Corps on the proposed extention of the breakwater at this city. The estimate of the proposed extension of 2,000 feet is \$100,000. 2,000 feet is \$300,000.

MILWAUKEE, WIS.—Specifications are being made for about \$200,000 worth of sewer construction to be done here this spring.

CAMBRIDGE, INDIANA.—Concerning the report that water works were to be erected here our correspondent writes as follows: "No steps have been taken to establish waterworks; have wells and cisterns."

BIG STONE, DAK.—The Board of Trade favors diking Big Stone Lake and opening navigation from the lake to Lake Traverse.

ROCKLAND, MASS.—Concerning the reported water-works extensions here our cor-respondent writes as follows: "Extending of mains was left to Water Commissioners. Verv little, if any, is contemplated the present

Montgomery, Ala.—See our Proposal Column for advertisement of bids wanted for sewer construction here. It is probable that other work will follow, and information may be obtained by addressing R. B. Snodgrass, City Clerk. Rudolph Hering, C. E., of N. Y. is the consulting engineer.

LODA, ILL.—Concerning the published re-LODA, ILL.—Concerning the published report that water-works were to be erected here, we are informed as follows, by O. L. Closson, Village Clerk here: "We are not at the present time nor perhaps in the near future contemplating putting in any excensive waterworks. We sank two public wells last season and will do nothing more at present."

FORT FAIRFIELD, ME.-We are in receipt of the following communication from the Town Clerk at this place: "At a meeting of the Sarsfield Water Co., of Ft. Fairfield, Me., it was voted to transfer its charter rights to any party or parties who may contract for a water-supply with the Village Corporation Assess-

NORWALK, O .- It is probable that there NORWALK, O.—It is probable that there will be extensive changes made to the waterworks system here at an early date. The question of improving the present plant has been discussed for a long time, and recently a joint committee of members of the Water-Works Board, the Common Council, and private citizens investigated the matter and sub mitted a report to the city officials. The report recommends the building of two or more storage reservoirs, new pumping engines, and the recommends the building of two or more storage reservoirs, new pumping engines, and the addition of several dams, the whole cost of which is estimated at \$50,000. The matter is to be settled at an election to be held in April, and should it result in favor of the measure bonds in the sum required will be issued. Further investigation is to be made by an expert hydraulic engineer. For details address Frank Sawer, Town Clerk.

St. Paul, Minn.—The Fire Department talks of purchasing stand-pipes for use at fires in upper rooms of high buildings.

FARM'NGTON, ME.—We are in receipt of the following from E. J. Merritt, Chairman of the Board of Assessors of this place, dated March 3: "The Village Corporation voted yesterday not to contract with the water company. Our business men think it will come in pany. Our business men think it will come in the near future."

INDIANOLA, NEB.—City Clerk I. H. Berge. of this place, sends us the following communication in reference to the reported water-works project here: "The Board of Trade of this city is corresponding with different parties endeavoring to learn what the cost will be to dig a canal from one-quarter to one-half mile, with a fall of about ten feet south side of the with a fall of about ten feet, south side of the The committee appointed for this work have not reported yet, therefore cannot tell what success they have had so far. But a canal will be made, and that soon. For further particulars address S. R. Smith, Secretary Board of Trade, this city."

Braintree, Mass.—Concerning the report that the water-works here were to be improved we have received the following communication from Col. A. C. Drinkwater, of the Water Commission. "The town of Braintree, Mass., entered into contract with John Cavanagh & Son, of Boston, September 8, 1887, to put into our town a complete system of water-works, consisting of 12 miles of pipe, 100 hydrants, 100 gates, stand-pipe of iron, 100 feet high, 30 diameter pump of 15 000,000 gallons daily. The works are in process of building, and will be completed early in the spring of this year."

ASHEVILLE, N. C .- Concerning the report that a system of sewerage was to be erected here we have received the following communi-cation from F. M. Miller, the City Clerk: "An election has been ordered to be held on the 3d day of April next, to obtain the consent of a majority of the qualified and registered voters, to issue bonds of the city to the amount of \$60,000 for the construction of a system of sewerage."

St. Joseph, Mo.—Concerning the report that extensive sewerage construction was to be done here our correspondent writes as follows: "No action yet taken in regard to sewers except some small contracts for districts." Nothing will be done until after April.

ATCHISON, KAN .-- It is reported that plans are prepared for a sewerage system for this city, which is to cost, according to reports, \$1,000,000.

GRAFTON, W. VA .-- An election will be held here March 20 to decide for or against the construction of a system of water-works to cost \$28,000, from plans, etc., already made. The Mayor has charge of all details.

GUYANDOTTE, W. VA.—A water-works company has been incorporated to build a system here. The capital stock is \$100,000, and T. E. Stout, of Huntington, W. Va., is titched. at its head.

DALTON, GA.—It is stated that the Water-Works Committee will take immediate action towards the construction of the system heretofore reported.

BENTONVILLE, ARK.—It is reported that a system of water-works will be erected here by parties from Kansas City, Mo.

SALISBURY, MD. - It is said that the Water-Works Committee will proceed at once toward the details of the proposed system.

PINEVILLE, KY .- It is reported that waterworks will be erected here by the Pineville Coal, Iron and Land Co.

HOT Springs, Ark.- It is reported that the plant of the Hot Springs Water-Works Co. will be enlarged.

BATESVILLE, ARK.—A. A. Webber, Esq., writes: "The Batesville Water Company is not organized as yet, but will be in a few days—just as soon as a balance of \$2,000 is subscribed. Capital stock, \$10,000. Soon as all stock is subscribed the company will be organized and work will commence at once." ized and work will commence at once.

HEBRON, NEB.—Water-works are to be erected here. Details can be had of the Village Clerk.

CAPAC, MICH.—Water-works may be established here. For details address the Water-Works Committee.

COLUSA, CAL.—An 80 foot tank is to be erected here for fire protection. Water Works Superintendent J. B. Cook can give details.

SYRACUSE, N. Y.—The Syracuse Water Company has submitted the following proposition to the authorities of that city conditioned on a guarantee that they shall have the exclu-supplying at least 20,000,000 gallons in 24 hours; (2) to furnish the highlands with a full and ample supply: (3) to extend its present sys-tem in all the old wards and throughout the three new wards, which will require the laying of at least 30 miles of pipe; (4) to begin work immediately and complete it without any unnecessary delay.

MARION, O., will build a system of sewerage this season. Plans now being made.

LAKEFIELD, ONT.-A \$5,000 water-works is contemplated for this place.

WHITEWATER, WIS. -Address Mayor Engerbretsen for details of a contemplated rater-works system here.

PARK HILL, ONT.—A water-works system may be established hete. For details address

WATER-WORKS.—See our proposal column for information regarding water-works and water-works supplies at the following places: Paisley, Ont.; Merriton, Ont.; Albany, N. Y.; San Antonio, Tex.; Columbus, Ga.; Asbury Park, N. J.; Raleigh, N. C.; Newport, R. I.; Fort Riley, Kan.; Montgomery, Ala.; St. Paul, Minn.

BRIDGES.

WILKINS, WYO.—A 60 foot iron bridge is to be erected here. See our Proposal Col-

VERNON, TEX.—A \$32,000 bridge is to be rected here. Address the County Commiserected here. sioners for details.

MONTREAL, CAN.—Reports say that engineer Henry Malingee is preparing plans for the proposed new bridge to connect this city with Longueuil, to cost between \$4,000,000 and \$5,000,000.

MONORA, IOWA.—A bridge is to be erected over the Missouri River by the counties of Monora, Iowa, and Burt, Neb.

MILWAUKEE, Wis. — The Chicago and N.W. Railway will build a \$10,000 iron bridge Digitized by

BRIDGES.—See our Proposal Column for information regarding bridge construction, etc., at the following places: Montreal, Can.; Wilkins, Wyo.; Thomaston, Ga.

HUNTSVILLE, ALA.—An iron bridge is to be erected over Pinhook Creek. Address the Town Clerk of this place for details.

TOMAHAWK, Wis.—A 468-foot bridge is to be erected over the Wisconsin River at this

THOMASTON, GA.—Concerning the report that a bridge was to be erected here over the Flint River our correspondent writes as fol-lows: "The bridge has been built, but the contract to inclose and cover it will be let to the lowest and best bidder on March 20."

RAILROADS.

BROOKLYN, N. Y .- The Common Council has received an application from the Fort Hamilton and New York Elevated Railroad for a franchise to build and operate an elevated road from Fort Hamilton through Third Avenue to Atlantic and thence to South Ferry.

DAVENPORT, JA .- The Rasmussen cable system will be put in the street-car line. Dr. W. L. Allen has bought a controlling interest.

CHICAGO, ILL.—It is said that the Chicago. Milwaukee and St. Paul Company will soon build a link connecting the line from Mazoma-nie to Prairie du Sac with the main line at

WINNIPEG, MAN .- Premier Greenway has, it is said an offer to build the Red River Valley Railway from a reliable firm. The offer is to build the road from West Lynne to Portage La Prairie, the Government to pay a small cash bonus and an annual subsidy for a period of twenty years.

STREET-WORK AND PAVING.

LINCOLN, NEB .- The City Engineer can furnish details of considerable paving. etc., to be done here.

PLATTSMOUTH, NEB.—It is reported that considerable street work is to be done here this spring.

FINDLAY, O.—Several miles of asphalt paving will be laid here in the spring. F. Arford can give details.

COLUMBUS, O .- Address the City Clerk for details of a large amount of street work to be done here soon.

ST. JOSEPH, Mo.—Our correspondent here sends us the following communication con-cerning street-work: "People are talking of vitrified bricks and cedar blocks, and something in this line will probably be done during the summer, but have nothing definite to report as yet.

NEWPORT, R. I.—See our Proposal Column for information regarding paving to be done in this city.

GAS AND ELECTRIC-LIGHTING.

MACHIAS, ME.—An electric-light plant is to be erected here.

PITTSFIELD, Mr.—Two electric-light com-panies have been organized here. Darius Burns is at the head of one and Davidson Walker leads the other.

WARE, MASS.—The electric-light company at this place will purchase a 50 horse-power engine, two boilers, dynamos, etc.

VINEYARD HAVEN, MASS .- An electriclight company has been organized here, with Otis G. Stanley as president.

BROOKLINE, MASS.—The Citizens' Electric-Light Company has been organized here and will at once begin the erection of a plant.

WAKEFIELD, MASS .- The electric light question is being agitated here.

PLYMOUTH, MASS. The local gas-works are to undergo extensive additions.

THAYER, KAN.—C. T. Ewing is at the head of a newly organized electric-light company here.

JOPLIN, Mo.—The Joplin Electric-Light and Power Co. has been organized here and a plant is to be erected at once.

PATCHOGUE, L. I.—The Patchogue Electric Light Company has been incorporated. The capital stock is \$20,000, and the incorporators are J. S. Havens, George D. Gerard,

NEW BRIGHTON, S. I.—This place is to be lighted by electricity by the Richmond Light, Heat and Power Company.

NORWICH, N. Y.—It is reported that this place is to be lighted with electricity.

MILLERSBURG, O.—The officials will put in a 50-light electric-light plant.

PINEVILLE, KY.—Reports say that the Pineville Coal, Iron, and Land Co. will establish gas-works here.

JACKSO NVILE, FLA. - Reports say that the Jacksonville Gas Co. has decided to add machinery to manufacture gas by the Loomis

NEW ORLEANS, LA.—The Louisville Electric-Light and Power Co. will add an incandescent plant to its establishment it is reported.

RICHMOND, KY .- It is reported that extensive new machinery will be placed in the Richmond Gas Company's works. For details address Frank Adair, one of the reputed pur-

HEBRON. NEB .- An electric-light is to be established here.

BIDS OPENED.

MINNEAPOLIS, MINN.-The Council Committee on Water-Works met to open bids for constructing the trusses at the North Minneapolis pumping station. Five bids were received, but as the work had not been advertised, the committee concluded to return them unopened. Engineer Cappelen was in-structed to invite proposals for furnishing the trusses, sash and doors, terra cotta and cut

LANCASTER, PA.—The contract for the erection of the Farmers' Southern Market House in this city has been let to J. Adam Burger for \$27,500. C. Emlan Urban is the

ST. PAUL, MINN.—The following bids for ST. PAUL, MINN.—The following bids for the iron roof-trusses, sash, doors, and stone for the North Minneapolis pumping-station were opened March 2 by the Council Committee on Water-Works: Trusses — Herzog Manufacturing Company, \$6,500.07; De Soto Boiler-Works, \$4,900.80; Houston & Harris, \$4,298.34; M. W. Glenn, \$4,782; Shiffer Bridge Company, Pittsburg, \$5,100; Canton Bridge Company, \$3,895; Chicago Forge and Bolt Company, \$3,950. The contract was awarded to the Canton Bridge Company, of Canton, O. For terra-cotta—Houston & Harawarded to the Canton Bridge Company, of Canton. O. For terra-cotta—Houston & Harris. \$3.575; G. W. Turnbull. \$2,730; C. S. Leeds. \$3,250. F. Jenson was the only bidder on stone. His proposition included the furnishing of three kinds of stone: Kasota, Bayfield brown, and Bedford stone. ranging in prices from 70 cents to \$1.60 per cubic foot. Four bids for sash and doors and other woodwork were handed in work were handed in.

NEW HAVEN, CONN.—The following bids NEW HAVEN, CONN.—The following bids for constructing a sewer on Davenport Avenue were opened February 29 by the City Engineer: Anthony Carroll, \$29,359.50; Patrick Maher, \$29,311; C. W. Blakeslee & Son, \$26,759; Matthew Kehoe, \$26,000; Lawrence \$20,759; Mattlew Kehoe, \$20,000; Lawrence O'Brien, \$25,392. all of New Haven; Harris & Maguire, Brooklyn, N. Y., \$24,763.20; A. Brazos & Sons, Middlefield, Conn., \$24,616.30. The contrict was awarded to A. Brazos & Sons.

The following bids were received for masonry for sewer in Boulevard: Bruen & Shepsonry for sewer in Boulevard: Bruen & Snepard, \$53,309,50; Anthony Carroll, \$57.745; Patrick Maher, \$49,943; C. W. Blakeslee & Son, \$49,307.50; L. O'Brien, \$39,365, all of New Haven; Harris & Maguire, Brooklyn, New Haven; Harris & Maguire, Brooklyn, N. Y., \$49,883. The contract was awarded to L. O'Brien.

NEW YORK CITY.—None of the bids submitted to the Department of Docks, to be opened March 6, for removing the old pier at the foot of North Moore Street, and building a new one, were opened, as it was ascertained that access could not be had to the premises on which the pier stood until certain legal restrictions had been overcome. The work will be readvertised as soon as the department is in a position to proceed.

ST PETER MINN.—Ten bids have been opened on water-works construction.

BEATRICE, NEB .- The following bids for sewers were received by W. A. Wagner, City Clerk, March I: E. J. Hanlon, Sioux City, lowa, \$28,790.50; John Layne, Lincoln, Neb., \$20,723.36: F. S. Blodgett, Milwaukee, Wis., \$32,239; Shannon & Kilpatrick Bros., Beatrice, \$29,600; W. H. Duffit, Leavenworth, Kan., \$27.928.45.

FINDLAY, O.—The following bids for pumping-engines, pipe, castings, etc., were received by Water-Works Committee February 15:

Pipe, Addyston Pipe and Steel Co., Newport, Pipe, Addyston Pipe and Steel Co., Newport, Ky., \$70,074.40; Pipe-laying, James J. Rumsey, Canton, O., \$23,820.71; Hydrants, Bourbon Brass and Copper Works, Cincinnati, O., \$4,823; Valves and Boxes, Eddy Valve Co., Waterford, N Y., \$2,609.60; Machines, Gordon & Maxwell Mfg. Co., Hamilton, O., \$16,607.

CLEVELAND, O .- The following bids for furnishing pipe, etc., to the Water Department for the year 1888 were opened, March 6, by John Whitelaw, Superintendent Water-

R. D. Wood & Co., Philadelphia, Pa. 3-inch, \$31.20 per ton; 4-inch, \$28.80; 6 and 8 inch, \$28.20; 10 and 12 inch, \$27.80; 30inch, \$26.95.

Lake Shore Foundry, Cleveland, O., 4-inch,

\$34; 10 and 12 inch, \$12; special castings, 3 to 12 inch, 2\(\frac{1}{4}\)C.; 30-inch pipe, \$26.50; spe-

cial castings, 30-inch, 3c.
Ohio Pipe Co., Columbus, O., 4-inch, \$29;

special castings, 3 to 12-inch, 3½c; 30-inch pipe, \$29.97; special castings, 30-inch, 3½c. Addyston Fipe Co., Cincinnati, O., 4-inch, \$29; special castings, 3 to 12 inch, 2½c; pipe, 30-inch, \$28.50; special castings, 30-inch,

Buffalo Cast Iron Pipe Co., 4-inch, \$28.40; special castings, 3 to 12 inch, 3c.; pipe, 3o-inch, \$25.85; special castings, 3o-inch, 33c. New Philadelphia Pipe Works, 4-inch,

\$27.10; special casrings, 3 to 12 inch, 3c. NEW YORK CITY.—The following bids for altering the plumbing of the City Hall, according to specifications prepared by Albert Webster, civil and sanitary engineer, and submitted in response to invitations issued to a number of selected plumbers, were opened at the Department of Public Works March 3.

For all work called for on plans and specifications and not included under "additional prices" below, and other work complete on main drain to a point 35 feet east of the east wall of the building, the bids were as follows:

Delany & Ward, \$17,200; Moody & Bracken,

\$11,350; Durham House Drai \$14,900; John Renehan, \$18,000. House Drainage Co.,

"The bids for which came under the head of additional prices" were as follows:

Emptying cesspools—Delany & Ward, \$6 per cubic yard; Moody & Bracken, \$35 each per cubic yard; Moody & Bracken, \$35 each cesspool; Durham House-Drainage Co., \$100 each cesspool; John Renehan, \$250 each cess-

Removing all sewage and polluted earth cher than excavations necessary for trenches:
Delany & Ward, \$4 per cubic yard; Moody &
Bracken, \$5 per cubic yard; Durham HouseDrainage Co., \$2 per cubic yard; John Renehan, \$3 per cubic yard.

For trenching and tunneling and laying vitrified drain, complete, estimating 120 feet of trenching and 20 feet of tunneling, beyond work covered by the general contract price, the bidders were as follows: Delany & Ward, \$3,080; Moody & Bracken, \$300; Durham House Drainage Co., \$400; John Renehan,

For extra work—Delany & Ward, 10 per cent. on net cost; Moody & Bracken, 10 per cent.; Durham House Drainage Co., 15 per cent.; John Renehan, 20 per cent.
Time—Delany & Ward, 60 days; Moody

& Bracken, 30 or 40 days; Durham House Drainage Co., 60 days; John Renehan, 100

The following firms put in bids to do the entire work for 10 per cent. on the net cost: Byrne & Tucker, James Muir, Locke & Mon-The contract has been awarded to Moody & Bracken.

NEW YORK CITY.-In our account of bids opened by the Aqueduct Commissioners for cast iron pipe and special castings for the pipeline, published last week, the total prices were given. The prices per ton were as follows: Walter Wood, cast-iron straight pipe, \$24.80; special pipe castings \$27; Reading Foundry Co., 5,000 tons cast-iron straight pipe \$28, special pipe castings, \$41.50; Warren Foundry and Machine Co., cast-iron straight pipe \$24.40, special pipe castings, \$55; McNeal Pipe and Foundry Co., cast iron straight pipe \$25.50, special pipe castings, \$48; Quassick Iron Co, cast-iron straight pipe \$26.45. special pipe castings, \$55.

GOVERNMENT WORK.

PHILADELPHIA, PA.—Abstract of proposals for removal of the wreck of the schooner "G. H. Berst," lying in Delaware Breakwater Harbor, opened March 5 by Lieutenant-Colonel Henry M. Robert, Corps of Engineers: Elihu J. Morris and Charles W. Johnston, Lewes, J. Morris and Charles W. Johnston, Lewes, Del., \$824; Joseph D. Truxton, Lewes, Del., \$794. The bid of Joseph D. Truxton was recommended for acceptance.

MISCELLANEOUS.

NEW ORLEANS, LA.—It is reported that a dock, to cost \$100.000, is to be erected here, and that Octave Vallette can furnish details.

NEW YORK.—Complaint has been made to the Board of Health, by Fish Commissioner Blackford, of the filthy condition of Fulton He states in his complaint that refuse is carried by the sewer into the slip and contaminated the fish in cars. The board will ask the Department of Public Works to extend the sewer beyond the pier and the Department of Docks to dredge the slip.

BANGOR, ME.—An electric street-railroad is to be established here.

PROPOSALS.

(Continued from page viii.)

COURT-HOUSE.—Proposals are wanted at Doug-las, Ga., until April 2. for the erection of a court-house. Address Enjah Paulk.

JAIL - Proposals are wanted at Louisville Kv., until April 2, for the erection of a jail. Address James F. Brown, as above.

COURT HOUSE.—Proposals are wanted at ville, I a., until May 1, for the erection of a court to cost \$22,000. Address W. W. Edwards.

WATER-WORKS.—Proposals are wanted at Paris, Ky., for the erection of a system of water-works. No date specified. Address the Mayor.

STONE.—Proposals are wanted at Washington, D. C., until March 31, for furnishing the dimension stone required for the walls of the cellar or sub-basement story of the Congressional Library Building, to be constructed in Washington, D. C. Address William F. Vilas, of the Commission for the construction of the building.

building.

SEWERS AND STREET WORK.—Proposals are wanted at Jersey City. N. J., until March 26, for constructing sewers in certain streets; also for street improvements. Address Martin Finck, Clerk, Eoard of Public Works.

PAVING.—Proposals are wanted at Albany, N. Y., ntil March 19 for paving, etc., certain streets. Ad-ress Thomas J. Lenahan, Clerk, Board of Contract Apportionment.

STREET WORK. - Proposals are wanted at Phila-delphia, Pa., until March 16 for making repairs to cer-tain streets. Addiess Louis Wagner. Director, Rureau of Gas.

PIG LEAD, LEAD PIPE AND SHEET TIN.— Proposals are wanted at Philadelphia, Pa., until March 16, for furnishing pig lead, lead pipe, and sheet tip, according to specifications. Address Louis Wag-ner, Director, Bureau of Gas.

PIPE, HYDRANTS, ETC.—Proposals are wanted at Buffalo, N. Y., until March 20, for furnishing castiron pipe, special castings, valves, hydrants, cocks and plugs, casti-iron valve and service boxes, pavements, and vitrified sewer and drain pipe according to specifications. Address L. P. Reichert, Water Commissioner, as above.

SIFAM ELEVATOR.—Proposals are wanted at New York City, until March 16, for a steam elevator at Charity Hospital, Blackwell's Island, New York, Address the Department of Public Charities and Correction No. 66 Third Avenue.

WATER-WORKS.—Proposals are wanted at Tecumseh. Neb., until March 29, for constructing, etc., a complete system of water-works. Address P. A. Brunelage, City Clerk.

STREET SWEEPER.—Proposals are wanted at Nashville, Tenn., until March 13, for a horse street sweeper. Address the Board of Public Works and Affairs.

SEA WELL.—Proposals are wanted at Boston, Mass., until March 14. for rebuilding the sea wall on Roxburv Canal, according to specifications. Address H. T. Rockwell, Chairman Boston Water Board.

JAIL.—Proposa's are wanted at Louisville, Ga., unt. April 3, for building a jail for Jefferson County. Address James F. Brown, Louisville, Ga.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; 4s dwell, brown-stone dwelling; apart house, upar heni-house; ten, tenement: c, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

76 Oliver, br flat; cost, \$18,000; o, David Daly; a, Andrew Spencer.

33 Henry, br flat: cost. \$16,000; o, Thomas McHugh; a, Alex J Finkle.

BUILDING INTELLIGENCE. NEW YORK-(Continued)

N s 54th, 175 w Tenth av, br dwell; cos, \$9,500; o. Jacob Ekz; a, Thom & Wilson 104 West 3d, br flat: cost, \$18,000; 0, job C Hoch; a, Kurtzer & Rohl.

N s 105th, 100 e oth av, 2 br flats; cos \$41,000 all; o, Mary Mitchell; a, Thoma

N w cor 125th and Eighth av, br flats; cos \$16,000; o, Michael J Adrian; a,] Bocke, &

S s 74th. 400 w oth av, 5 br dwells; con \$125,000 all; o, Mary J Coar; a, E L Angell N e cor 104th and Fourth av, br flat; cos \$18,000; o, Mrs Crockell & Maggie Wills; 4. Jas Cregin.

N s 104th, e Fourth av. 3 br flats; cost \$45,000 all: o and a, as above.

224 East 43d, br stable; cost, \$19,000; c Chas V Schmidt; a, Fred Ebeling.

E s Lincoln av, 100 e Southern Boulerard, br store; cost, \$25,000; o, Henry Spies, 4,0 C Buck.

Lispenard, br store; cost, \$90,000; 0, John Glass; a, G A Schillinger.

Ridge st, Nos. 87 and 89, rear, br blig cost, \$8,000; o, Charles Decker; a, Fred E

Wall st, Nos. 45 and 47, br bank and offer bldg; cost, \$400,000; o, United States Trest Co; a, Robert W Gibson. 24th st, Nos. 429 and 431 West, 2 br store flats; cost, \$20,000 each; o, Jacob Dieter, 2

Berger & Baylies. 25th st, Nos. 215 and 217 East. 2 br fass.

cost, \$38,000; a, Kentz & Lange. 21st st, No. 333, n s, 325 e 9th av, br store flat; cost. \$18,000; o, James H Havens; a Ralph S Townsend.

3d av, Nos. 455 and 457, rear, br ten; cost. \$15,000; 0, Jacob Schmitt; a, Wm Graul.

75th st, Nos. 318 and 320 East, br factory cost, \$18,000; o, F S Myers; a, George H Budlong.

MISCELLANEOUS.

ST. PAUL —Friends of Bishop Gilbert of Episcopal Church have raised \$10,000 to build him a residence.

A new Turner Hall, to cost \$50,000, will be built. Leading Germans are interested.

ST. PAUL .- Summitt, nr Rice, 3 story by bldg; cost, \$13,000; o, M Church.

Jackson, nr Seventh, alterations; 2081. \$14,000; o, Plymouth Clothing House. Carroll, nr Summit, 3 story fr dwell: cost, \$15 000; o, A Defeil.

MIDDLEBORO, MASS.—The Central Baptist Society, Middleboro, Mass., will rebuild their church recently destroyed by fire. Will expend about \$20,000. Plans or materials not yet decided. W. H. Southwerth is not yet decided. W. H. Southwest Chairman of the Building Committee.

SVRACUSE. -- Burnett, br flats; cost, \$7,000 o, B Stephenson; a, C E Colton.

Salina, br house; cost, \$15,000; 0, CL Hoffman; a, C E Colton; b, Umbrecht.

University av, Training School for Nurses; cost, \$7.000; o, House of Good Shepherd; a, C E Colton; b, J W Gee.

Union av, br house; cost, \$6,000; 0, C Schlosser; a, C E Colton; b, H Ryan.

Division, brewery; cost, \$50,000; 0, National Co; a, C E Colton; b, O'Brien. Oak, dwell; cost, \$7,000; o, H Beards lee; a, C E Colton; b, E Hondo.

MINNEAPOLIS, MINN.—601 Hennepin 2 story br dwells; cost, \$25,coo; o, W H Eustis (Union League Club House); a, not

YOUNGSTOWN, O .- All the plans have been completed for the new depot for the P. Y & A RR, and work will be commenced soon as the contracts can be awarded The sum of \$130,000 will be expended in the improvements here.

MILWAUKEE, WIS .- E s 5th, bet Grand av and Wells, br club house; cost, \$15,600 o, St Andrews Society.

Galena, 2 fr dwells; cost, \$7,000; o, Emil

484-488 E Water, 4 storage warehouse. cost, \$15,000 to \$20,000; o, M J Bohan; b. not let.

Se cor East Water and Biddle, br bldg. cost, \$12,000; o, Wm Franzen; a, open.
21 bldgs less than \$5,000. Googic

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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NEW YORK'S SNOW EMBARGO.

PROBABLY no one now living can recall such a snow-storm in New York as the one which visited that city on Monday of this week. A fall of about two feet, accompanied by gales of wind, made streets impassable for vehicles, stopped travel for days on the surface railroads and for one day on the elevated railroads. Business was suspended; factories and office buildings found themselves without coal to make steam for heating or to run machinery; restaurants on Tuesday put out signs, "No coal, no food"; communication by telephone and telegraph was interrupted. Indeed it is not possible to convey to any one who did not experience it the completely prostrated condition of the metropolis. providential absence of any serious fire alone saved it from a calamity such as visited Chicago in 1871. The managers of the elevated rail-roads were the first to offer any assistance to the public, as they were able to get their trains running with regularity on Tuesday afternoon, and, considering the difficulties they had to contend with, deserve great credit. And in Brooklyn credit is also due Chief Engineer C. C. Martin, of the Brooklyn Bridge, and Colonel Martin, the Superintendent of the Brooklyn Elevated Road, for the admirable service they rendered the public.

The advocates of the various tunnel schemes of rapid transit will no doubt be able to make a strong argument for tunnels as against Mayor Hewitt's suggestion for an open-Yet, notwithstanding our expericut route. ence of the last week, we still adhere to the belief that a viaduct is much the best for rapid transit routes in this city. Even with such a storm as this, travel on a four-track viaduct road would not have been interrupted more than half a day, and we believe the people would rather suffer such a detention one day in a year than ride every day in a tunnel. The worthlessness of suspended telephone, telegraph, and electric-light wires was again fully demonstrated, and the impossibility of communicating by telegraph added greatly to the embarrassment of the snow embargo. It is to be hoped that within a year we may see every wire placed underground; and if the storm will hasten the municipal improvements that are plainly imperative to those familiar with municipal prob-lems, it will have proved a blessing in disguise.

OCEAN WEATHER CHARTS.

THE monthly Pilot Charts issued by the Hydrographic Office of the United States Navy Department, in charge of Commander J. R. Bartlett, are weather maps of the North Atlantic Ocean, containing a general summary of meteorological conditions prevalent during the preceding month and a forecast of the weather for the month following. Much information of interest and value to mariners is graphically represented on the chart—viz.: Direction and force of winds, limits of trade winds, region of equatorial rains, fog belts, probable limit of fog, probable limit of field ice and icebergs, names, position and character of wrecks and other dangerous obstructions, trade routes, in both directions, between the equator and New York and between the equator and European ports, transatlantic steamer routes, notices to mariners, bar-

ometric comparisons, storm cards and directions in case of cyclones, and frequently reports of the use of oil to smooth the sea, and other similar items of interest.

These charts are issued gratuitously by branch hydrographic offices in the principal ports in return for meteorological journals kept by ship captains, from which the information on the charts is chiefly compiled.

During the year ending June 30, 1887, 527 meteorological journals of ships were received, representing careful and detailed observations made daily during voyages of the following vessels: 142 British, 127 American, 18 German, 13 Norwegian, 6 Italian, 5 Hawaiian, 3 Austrian, 3 Danish, 3 Swedish, and 1 Dutch.

It is intended to loan standard meteorological instruments to all captains who will agree to keep journals for the Hydrographic Office, and the small necessary expense would be amply justified by the value of the records.

In many cases the captains use the Pilot Charts as track charts, and make meteorological observations thereon, plainly indicating the value of the forecasts.

Weekly supplements are issued for the Atlantic coast of the United States, and in time it is hoped to embrace the whole world in these or similar charts of weather probabilities.

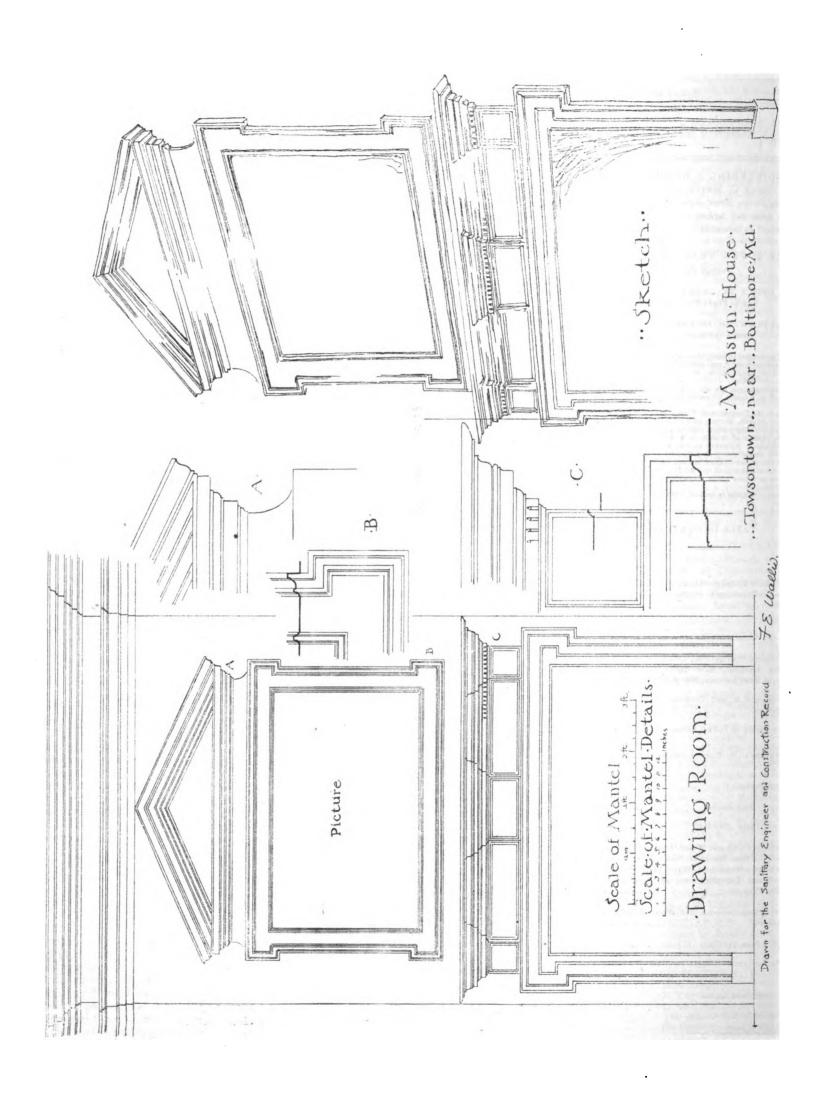
PATENT SEWER-GAS DESTRUCTORS.

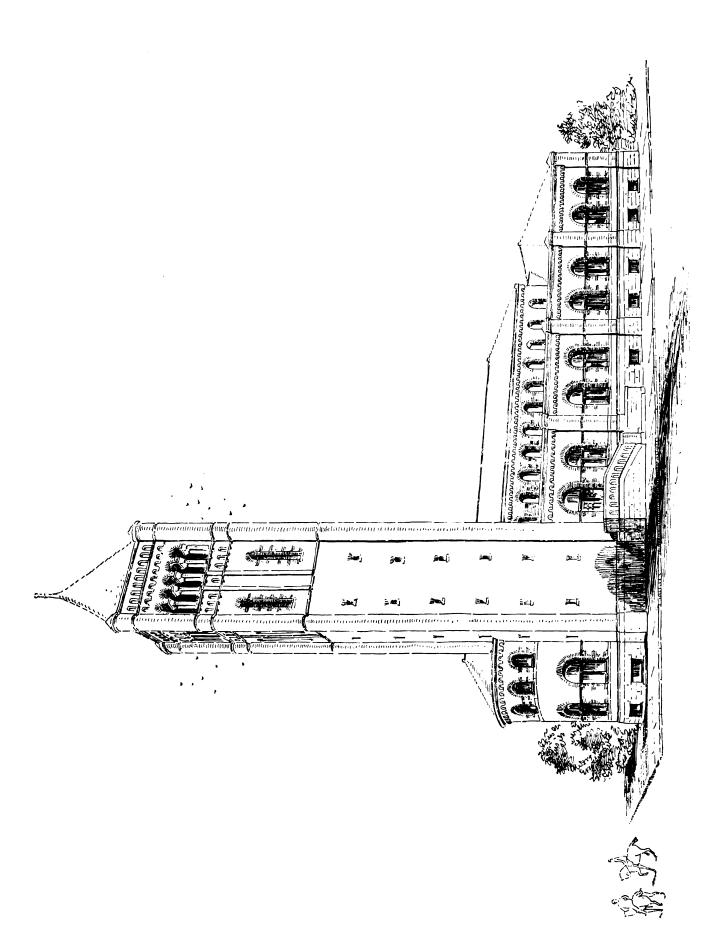
Among the list of the pleasures of life the orator of the future will probably class that of discovering how to ventilate sewers and disinfect sewer-gases by means of fire. The number of people who make this discovery annually seems to be considerable, and it is only necessary to hear them discourse for five minutes on the subject, or to read an account of the results obtained by their patent systems, to be convinced that this good old discovery gives just as much satisfaction now as it did eighteen hundred years ago, when it was proposed as a means of ventilating the Cloaca Maxima in Rome.

In view of this fact it seems cruel on the part of skilled engineers to continue pointing out, as they do, that all schemes of this kind are worthless, because of the great expense which they involve, and because equally good results can be obtained very much more cheaply.

The real cruelty, however, would be to permit cities to waste the people's money on such contrivances.

Take, for instance, one of the latest devices patented, and noticed in a paper read before the English Society of Medical Officers of Health, called "a sewer-gas extractor and destructor, which is described as consisting of "a hollow iron column similar in appearances to a gas-pillar, having in the interior of the base a gas-furnace of peculiar and novel construction". This iron solution This iron column is to be six struction. inches in diameter, the velocity of the current through it is to be from four to five feet per second—that is, it is intended to pass fifty cubic feet of air per minute or 3,000 cubic feet per hour, by the combustion of six cubic feet of coalgas. How many such iron columns would be required to ventilate the sewers of New York City, and how much gas would it take to run them throughout the year? There "are millions in this scheme" for some iron-works and some gas company if they could only get the necessary appropriations for it.





THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

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This, however, is merely a type of what has been proposed a hundred times before, and which no doubt will be proposed several hundred times more in the future. How it is possible to patent these things as "useful inventions" is a mystery to any one but a patent expert. The only people to whom they are useful, so far as we can see, are the printers and advertising mediums, but as sources of happiness to their inventors they are no doubt temporarily successful, and they show that there is still some faith left in a few, at least, of the dwellers in this wicked world. We have some reason to think that there would be a large increase in the number of announcements of such inventions if the correspondence of the inmates of our insane asylums were less carefully scrutinized and weeded out, and it may be that the Government is in this way deprived of a certain amount of revenue in the shape of patent fees; but the time is probably not yet ripe for agitating for reform in this matter, and we only mention it to show that we understand and fully sympathize with inventors of this class.

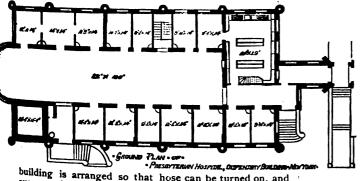
PROPOSED ABOLITION OF DUTY ON CEMENT.

The proposition to place cement on the free list in what is known as the Mills Tariff Bill has brought out a statement from those interested in the cement industry in this country, which we publish in another column.

Cement is certainly a manufactured article. In view of this fact, therefore, and that even tariff reformers only urge that strictly raw materials and articles not produced in this country be put on the free list and are agreed that the tariff on articles should be so adjusted as to interfere as little as possible with the wages of laborers in the United States, it would seem from the statement elsewhere published that the abolition of the small existing duty of twenty per cent. on cement is not justified. The result would be to lower the rate of wages of those engaged in that industry and check the manufacture and increase by at least a portion of that twenty per cent. the income of foreign manufacturers.

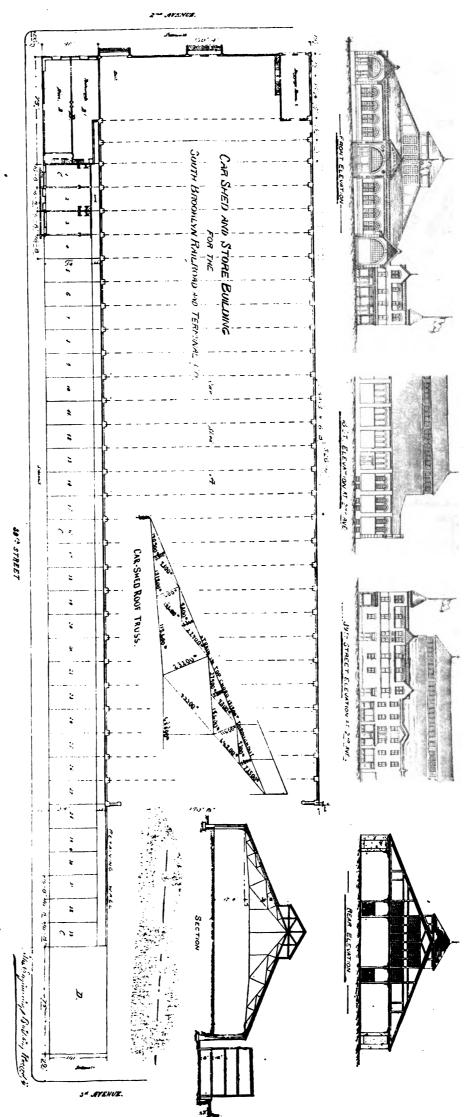
OUR ARCHITECTURAL ILLUSTRATIONS. DISPENSARY BUILDING, PRESBYTFRIAN HOSPITAL, NEW YORK.—J. C. CADY & CO., ARCHITECTS.

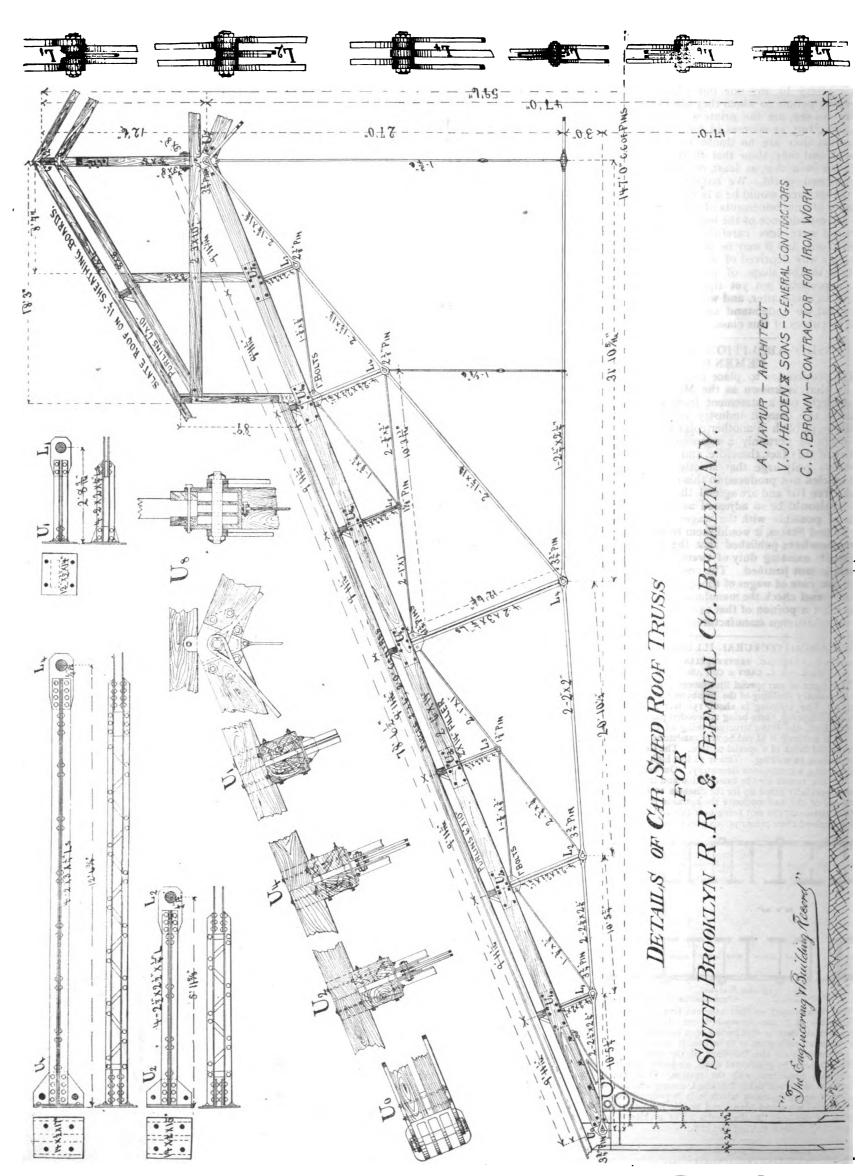
THE subject of our special illustration this week is the new Dispensary Building of the Presbyterian Hospital in this city. The building is about 150 feet long, 50 feet wide, and fireproof, there being no wooden partitions, furring or beams, the entire structure being of masonry and iron. The exterior is of red Scotch sandstone and Baltimore pressed brick of a special pattern. The Central Hall is for patients in waiting. This is 30 feet high, the upper portion being a continuous clear story. On each side of this hall are rooms for the examination and treatment or patients, specially fitted up for the diseases to be treated. At the end of the hall opposite the entrance is an apothecary's department, the exit being near this so that patients having received their prescriptions pass directly out. The



building is arranged so that hose can be turned on, and every portion of it can be washed out, all crannies and places to retain dust or dirt having been carefully avoided. The tower at the corner is to be used in connection with the ventilation of all the buildings of the hospital, with which it connects by graduated ducts, air being forced by several fans connected with the system. Plans are in preparation for several other buildings, among which is to be a model operating-room which, it is hoped, will represent the most advanced views and be the most complete building of the kind in the world. The architects are Messrs, J. C. Cady & Co., of this city.

MANTEL IN DRAWING ROOM, MANSION HOUSE, TOWSON-TOWN, NEAR BALTIMORE, MD.





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STATION OF THE SOUTH BROOKLYN R. R. AND TERMINAL COMPANY.

This station is to afford a common terminus for the Coney Island and Long Island Railroads, and is designed to accommodate about ten tracks in the car-shed.

It is being built for the S. B. R. R. & T. Co. under the superintendence of A. Namur, architect, by V. J. Hedden & Sons, general contractors, and C. O. Brown, contractor for iron-work.

The depot and car-shed occupy a space 526' 6" x 150' 4", with an annex 40' x 175'. The brick walls are 24 inches thick, with "36-inch buttresses at truss-seats. The slate roof is supported by trusses spaced nearly 17 feet centres, and is lighted by a ventilator 36 feet wide, with side walls 8 feet high.

The main roof trusses are 147 feet span, 30 feet total rise, and 27 feet effective depth.

The top chords, purlins and jack-rafters are yellow pine.

The struts are each composed of four angles, with square end bearing against top chord, and pin connections with tension members, all of which are square bars with loopeyes reamed to fit pins within $\frac{1}{4}$ inch.

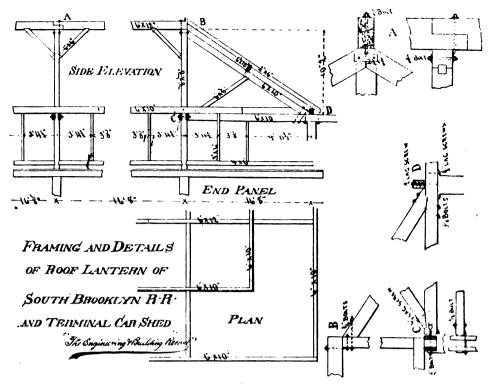
The only cast iron employed is in the corbel-brackets, peak-blocks and foot-pedestals, the latter resting at one end directly on stone wall caps, and at the other on expansion rollers. The connection of peak-casting to centre post of ventilator, the use of T-bolts for connections, and of twin planks for cross struts, together with other details of framing, are shown in the illustrations.

The roof is proportioned for a dead load of 40 pounds per square foot, and is considered so stiff in the purlin and rafter connections that lateral bracing in the end panels is omitted.

THE WATER-SUPPLY OF TOKYO, JAPAN.* By YBIJI NAKAJIMA, C. E., Imperial University, Tokyo, Japan.

Tokyo, or formerly called Yedo, is the present capital of Japan, and is the largest city in the empire. On the south it is bounded by the sea, and on the north and west there are many hill ranges. The heart of the city is traversed by many transportation canals. Its total area is 15,279 acres, or 23.87 square miles—a trifle larger than Manhattan Island. The total length of the streets is about 477 miles and they are, in general, very narrow. Most buildings in the business part are two stories high. The population of the city proper is 1,210,000, or 72.7 persons

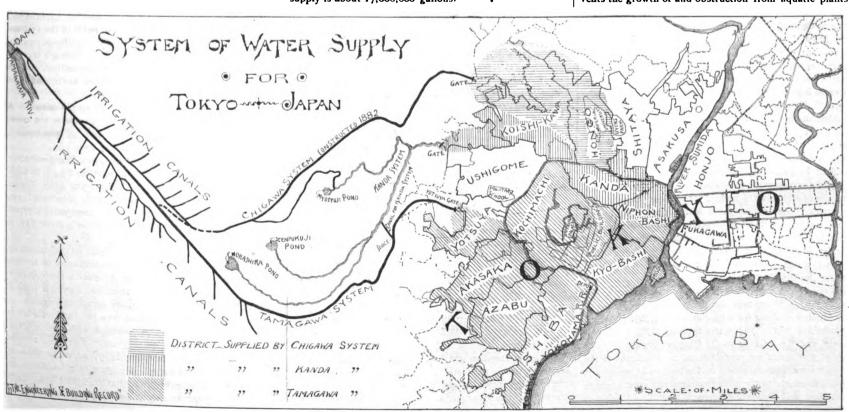
per acre.
"When Iyeyas, one of the most famous Shogun, decided to make Tokyo his headquarters, it was but a small town.



But his policy was to have all the nobility under his eye, so he ordered them all to reside in Tokyo, and this caused a very rapid increase in the population, as may be understood when it is remembered that some had armed followers to the number of 1,000, and each follower had his family." The water obtained was in general very bad, and in many places it contained salts and was not fitted for drinking purposes at all. Also in some parts the supply occasionally failed. Consequently, as the population increased, the necessity for water-supply was greatly felt, and the following works were consequently carried out, which, without material change, have supplied Tokyo until today.

In 1620 (though some say a little later), one of the Shogun ordered a man who had lived a long while in the neighborhood of Tokyo to consider the question of water-supply for the city. He proposed and constructed what is now commonly called the Kanda system. The three ponds—namely, that of Euokashira, Zenpukuji, and Myo-syoji—are the principal sources of this system, and a part of the water of the Tamagawa canal, which will be described further on, helps them. The respective heights of these sources are 147.5. 150.5, 137.5, and 129.6 feet above the sea. The waters from these four sources are combined in one canal and are distributed through a part of the city by various wooden pipes. This system supplies the wards of Koishi-kawa, Kanda, and part of Niphon-bashi. Its daily supply is about 17,000,000 gallons.

The other is called the Tamagawa system, and is more important than the one already described. The Shogun noticed the insufficiency of the then existing system, and, in 1651, he ordered a nobleman to consider its extension, or, more properly, the introduction of a new supply. It is said that accordingly two farmers who were well acquainted with the surrounding country were appointed to make surveys and report. It is also said that at that time there were no levels, and almost no surveying instruments of any description at all. However, somehow or other, they made the survey, and recommended drawing the water from the Tamagawa River. The plan was adopted, and the work was begun in April, 1652, and completed in November of the same year. They built a dam across the river so as to turn the water into the canal The height of water surface of the canal near the dam is 404 feet above the sea. The total length of the open canal from the dam to the Yotsuya gate, Tokyo, is 26.6 miles. There are two gates close by the dam and an overflow between them. From the dam for about 0.7 of a mile the width of the canal is about 30 feet, and the width of the remaining portion decreases from 24 to 18 feet. "The canal was skillfully placed along the plain which extends from the dam to Tokyo, so that no high embankments or deep excavations were needed. The velocity of the water is rather great, but it is quite uniform from one end of the canal to the other. The high velocity is beneficial, because it prevents the growth of and obstruction from aquatic plants,



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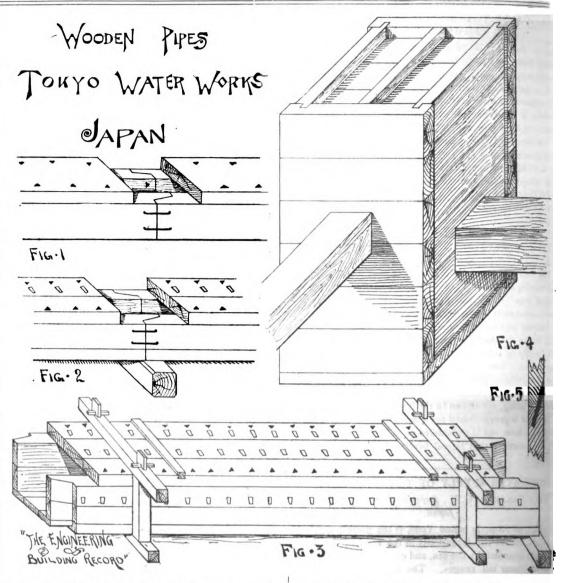
^{*}The materials for this description were furnished to the author mostly by Mr. R. Hara, C. E., in the Department of Public Works of Tokyo City, and considerable is quoted by permission from Prof. W. S. Chaplin's paper read before the New England Water-Works Association.

and the injury to the banks is less than would be expected, as the earth here hardens under the action of water." This canal serves also for irrigating the lands along the line. There are also several mills. The gate at Yotsuya regulates the water flow to Tokyo, and the extra water is drawn off by a waste-pipe. The daily supply by this system is about 24,000,000 gallons. This supplies the following wards—namely, Akasaka, part of Yotsuya, Azabu, Kochi-machi, Shiba, Kyo-bashi, and part of Niphon-bashi, as shown on the map. The total number of the people depending upon these two systems is about 400,000.

There is another, called the Chigawa system, which supplies a part of the wards of Koishi-kawa and Hongo. The daily supply is 1,400,000 gallons. It was reconstructed a few years ago.

Besides the above three systems, there had been introduced three or four other systems at various times, but none of them were successful on account of excessive cost of maintenance and all had been abandoned.

The distribution pipes are generally of wood; in dry places Retinispora Obtusa is used, and in wet grounds pine is used for pipes. There are many forms of wooden pipes in use. When the internal diameter is much less than 6 inches, a round timber with a circular hole through is used. When the pipes are a little larger, then a square timber is hollowed out so that its section looks like a U, and the top is covered with a plank which is spiked on (Fig. 1). The joints are well calked with a fibrous bark so as to prevent leakage. The connections between the ends of adjoining pipes are formed by chamfering the end of one pipe and enlarging the interior of the end of the next and driving the first into the second (Fig. 1). The pipe of this form is used when the side of the interior hole is less than six inches. In larger pipes the section is either square or rectangular, laid on the broad side (Fig. 2). The thickness of the planks forming the sides is from 21/3 to 6 inches. When these pipes are subjected to a considerable pressure, they are braced by frames of square timbers, as shown in Fig. 3. The largest wooden pipe in use is 3 feet in height by 41/2 feet in width, and the smallest one is 31/4 x 31/4 inches. The largest stone conduit is 5 feet in height by 6 feet in width, and the smallest one 1'6"x1'6". The total length of the wooden pipes now in use is 533,790 feet, or 101.1 miles, of which 290,470 feet belongs to the Tamagawa system, 221,210 feet to that of Kanda, and the balance to the Chigawa system. The total length of the stone conduit is 24,625 feet, of which 12,070 feet belongs the Tamagawa system and the balance to that of Kanda. The depth of the distribution-pipes is from 4 to 18 feet below the surface of the ground. The wooden pipes last from 10 to 20 years, according to the conditions of the soil. The distribution pipes of the three systems are not connected at all, though in some parts they come close together. Whenever there is an abrupt change in level, or there is a branch pipe, a square box is used, as shown in Fig. 4, whose sides vary from 21/2 feet to 6 feet, according to the sizes of the pipes. There are a great variety of the forms of these boxes, according to the locality, the head, etc. In some parts boxes are put simply for inspecting the flow and the quality of water. They may, to some degree, serve to make the flow in the pipes uniform. "The water is not carried from the mains into the houses, but is delivered into wells, which are usually on one side of the streets." Commonly, the connection of the well to the distribution-pipe is made by inserting one end of a 2-inch pipe about 3 feet long to the side of the distributionpipe and the other end to a square wooden box I foot 21/4 inches wide and I foot high, the thickness of which is about 21/3 inches. The connection of this box to the well is made commonly by a wooden pipe, the diameter of which is 21/3 inches. The wells are generally lined with wooden planks 5 or 6 inches wide and 2 inches thick fastened together by several bamboo bands in a cylindrical form. The height of each of these wooden cylinders is about 6 or 8 feet and their diameter varies from 3 to 4 feet. The depth of the wells depends upon that of the distribution-pipes near by. The top of the cylinder projects about three feet above the surface of the ground so as to prevent the danger of falling in. The total number of these walls now in use is 7,765, of which 2,935 belong to the Tamagawa system, 3,704 to that of Kanda, and the balance to the Chigawa system. "The ends of the mains are carried down to the banks of the canals, rivers, and the shore of the bay, and the water is allowed to escape freely, thus reducing the great pressure in the pipes and preventing injury to them." In this way



a great deal of water is wasted, though the exact amount is not known.

Analysis of Water Taken from the Tamagawa Conduit.

Impurities.	Grains per U.S. gal
Sodium carbonate	
Carbonate of iron	
Total impurities	2.053

Taken from the Tamagawa system in the heart of the city.

		1	M	P	UI	RI	TI	E	s.										Grai per J.S.	
Common salt																				430
Potassium chloride.																				067
Calcium carbonate.										 				 						268
Magnesium carbona																				027
Silica										 		 	 							544
Oxides of iron																				021
Phosphoric acid																				030
Alumina											٠.									044
Nitric acid												 								270
Organic matter												 								005
Total impurit	ies																	. 1	2.	706

Taken from the Kanda Conduit.

IMPURITIES.	Grains per U.S. gal
Calcium carbonate	. 102
Ferrous carbonate	
Calcium sulphate	
Magnesium sulphate	250
Calcium phosphate	
Chlorides of potassium and sodium	2=6
Ammonium nitrite	462
	589
Alumina	053
Organic matter and loss	431
Total impurities	3 - 542

Chemical examinations have shown that the water is contaminated in the distribution, for samples taken from the conduits showed no pollution, while those taken from the wells in the lower part of the city were decidedly bad, as shown in the analyses. These analyses show also that the water of the Tamagawa is much superior to that of Kanda.

"Several theories have been advanced to account for the contamination. One is, that as the pipes are usually below the level of the ground-water, though the head is greater inside the pipes, there is a continual diffusion of the impurities in the ground-water through the wood into the pipes. Another and more probable hypothesis is that, owing to the constantly changing level of the water in the wells which arises mostly from the small size of the pipes which connect the mains with the wells, the impure water from the ground makes its way through the leaky linings into the wells, and that the water thus polluted is carried at times back into the mains." In another experiment, water was taken out from the different parts of the systems on the same day; and the analysis of these different waters showed that the further the water flows through the distribution-pipes the greater is the contamination, and in the thickly-settled places the impurities are found to be more than in the thinly inhabited portions.

The water-rate for one well is \$4.50 per annum. A fountain-rate is double, and a waterfall-rate is ten times that amount. The average annual cost of maintenance for the three years (1883-84-85) is \$27,800.

Nearly all the people of the Fukagawa Ward and about one-fifth of those of the Honjō, altogether 89,450 in number, use water brought daily by boats from some distant rivers or from the outlets of the already mentioned systems. The quantity conveyed daily by these boats is 77,200 gallons. The daily cost of transportation is about \$45, of about \$16,425 per annum.

In the places where the above systems do not extend the people use the water of the common wells and of artesian wells. The total number now in use in the capital is 33,952. In general, the water from the common wells is much inferior to that of the already mentioned systems.

As the water of these systems has no head and as in many places it can hardly be obtained with convenience, the losses due to fire are quite great. The area covered by the buildings burnt in 1883 is 37 acres, in 1884 26 acres, and in 1885 32 acres. Nearly all the buildings are only one or two stories high, so that the losses due to these fires is not so great as might be supposed. It may be



fairly estimated that that losses from [buildings burned in these years are \$669,000, \$473,000 and \$585,000 respectively.

The following table shows the areas, population, den sity, and death-rates of differents wards:

Name of ward.	Area in acres.	Population.	Persons per acre.	Death-rate per 1,000 in 1885.	Death rate in 1886 (cholera prevailing.)
Kochi-machi. Kanda Nphn-bashi. Kyobashi. Shiba. Yotsuya. Azabu. Akasaka. Ushigome. Koishi-Kawa. Hongo. Shitaya. Asakusa.	1,638 724 686, 876 1,524 381 914 1,105 1,372 953 838 953 1,067	51,305 123,241 153,996 170,816 111,681 30,733 40,814 25,526 43,550 40,840 62,205 78,462 110,043 85,868 72,278	73.3 80.7 44.0 23.1 36.9 29.7 65.3 93.6	20.1 25.8 25.7 22.7 26.0 22.5 20.3 23.5 24.7 25.0 24.6 25.4 29.3 26.8	25.0 42.2 37.8 25.5 31.9 26.4 22.9 23.3(?) 25.3 31.2 34.1 22.0(?) 45.1 30.0 37.8

24.96 31.94 Wards marked (?) omitted in obtaining average death-rate for

From the above table we see that the death-rate is generally great where the water is bad.

About two hundred and fifty years ago very little was done toward systematic water-supply even in London, and the water works of Tokyo were quite large for that period. In fact, up to that time there had been no such extensive water-works constructed in the world except at Rome. However, gigantic as it may have appeared at the time of its construction, it cannot be compared in many respects with the present systems in America and Europe, and, therefore, it will, no doubt, be replaced by some better system in a few years.

[The scale on the map is correct only for the city of Tokyo; the conduits have been shortened nearly one-half for convenience of representation. The Tamagawa and Chigawa systems are shown in solid black lines merely to distinguish them from the earlier or Kanda system. The ramifications of the distributing-pipes through the city have been omitted as unnecessary and confusing on so small a scale.

The Japanese names in the city area are those of the different wards whose boundaries are shown by the irregular polygonal lines.

In Figs. I and 2 of the details the joint covers have been left off to show the construction of the joints. They are simply pieces of plank of the same thickness as the rest of the top and secured with spikes and clamps. The small black triangles are heads of iron spikes, and the somewhat larger four-sided figures show the ends of wooden pins driven obliquely through the joints of adjacent planks to fasten them together, as shown in Fig. 5.]

STATEMENT OF THE CEMENT INDUSTRY.

THE following is the statement prepared by those intrusted in the cement industry in the United States, alluded to elsewhere in this issue:

In the present tariff the duty is 20 per cent. ad valo-

In the proposed tariff cement is on the free list.

neither under the doctrine of admitting free "such raw materials as enter into American manufacture," nor under the doctrine of admitting free such articles "as will not interfere with American industry" can the placing of cement on the free list be sustained.

Cement is not a raw material; it is quarried, burnt, ground.

ground.

Cement enters into no other manufacture as a raw

material.

Cement is nearly 90 per cent. labor, and labor that costs several times as much in this country as in Europe.

Neither importers nor European manufacturers ask its admission free; and in point of fact the price in Europe to dealers for American shipment is 18 to 25 cents less than for the same cement for European consumption, just about the amount of the duty; so that putting cement on the free list would enable the European makers to raise their price half the amount of the duty, and still control the American market by reducing prices only a part of the duty taken off.

THE CEMENT INDUSTRY.

The manufacture of cement is not a local industry. It is national. Works exist in Maine, Connecticut, New York, Pennsylvania, Ohio, Maryland, Virginia, Washing-

ton, Oregon, Alabama, Colorado, Texas, California. Illinois, Wisconsin, West Virginia, Kentucky, Indiana and Michigan. It stands seventh on the list of non-metallic products of the United States. It ranks just below lime tallic products of the United States. It ranks just below lime and salt. It employs a capital \$8,000,000, has an output of over 5,000,000 barrels per annum and gives work to about 12,000 laborers. The largest works are in New York State where nearly 3,000,000 barrels are made, and 8,000 men employed; in Kentucky, where nearly 1,000,000 barrels are made and 1,500 men employed; and in Pennsylvania, where nearly 400,000 barrels are made and 600 men are employed.

MANUFACTURE AND CLASSIFICATION OF CEMENTS.

"Roman" cement is a natural rock, quarried, burnt in

kilns and ground.
"Portland" cer "cement is an artificial cement made by mixing chalk and clay, or limestone and clay, in varying proportions, grinding this to powder, making a brick or ball out of this moistened powder, and after calcining at high heat, this artificially-made new stone, by grinding

the resultant clinkers to powder.

The "Roman" corresponds substantially to the Rosendale, Louisville, and the majority of American

cements.

The "Portland" corresponds to the American "Portland and the this grade of cement The "Portland" corresponds to the American land." It has been claimed that this grade of cement cannot be made in this country for want of material. After fifteen years of experimenting, and after a loss running into millions, this statement has been controverted, and for five years past American "Portland" cements, "of a quality equal to any imported," and made in Pennsylvania, in Ohio, in New York, in Indiana, and in Texas, have been used on Government work (Vide Reports Engineer-Commissioner District of Columbia for 1883, 1884, 1886) and other public work, with parties concerns. 1884, 1885) and other public work, with entire success, and in competition with foreign cements. The Eads Jetties are built with American Portland cement (Vide Jetties are built with American Portland cement (Vide Captain Eads' Report on Mississippi Jetties); and the London and Southwestern Railroad of England actually, after a test, bought American Portland for one of its bridges (Engineeeing News, Vol. 1887). This cement must sell at a lower price than the imported, because of the established reputation of the older foreign brands; but with the abundance of limestone and clay in this country American manufacture will develop, and its product become established also come established also.

STATISTICS OF MANUFACTURE.

From the "Mineral Resources of the United States," United States Geological Survey, 1885, the following figures are given of the production of cement made from natural rock in the United States, from 1882 to 1885:

Production of Cement from Natural Rock in the United States from 1882 to 1885.

YEARS.	Bbls. of 300 lbs.	Averege price per bbl	Total value.
1882	3,165,000	\$ 1 10	\$3,481,500
τ883	4,100,000	1 00	4,100,000
1884	3,900,000	90	3,510,000
1885	4,000,000	90 80	3,200,000

In reference to American Portland the following estimates are made in the same work:

Estimated Production of American Portland from 1882 to 1885 :

YEARS.	Barrels of 400 lbs.	Average price per bbl	Total value.
1882	85,000	\$2.25	\$191,250
1883	90,000	2.15	193,500
1884	000,000	2.10	210,000
1885	150,000	1.05	202,500

The total production of all kinds of cement according to the same authority:

Total Production of all Kinds of Cement in the United States from 1882 to 1885:

Years.	Barrels.	Value.
1882	3,250,000	\$3.672,750
1883	4,190,000	4,293.500
1884	4,000,000	3,720,000
1885	4,150,000	3,492,500

From leading trade authorities it has been ascertained that the output of natural cement has increased to 5,000,000 barrels in 1887, with an average price of 75 cents; and the Portland cement industry has not appreciably increased, though prices have gone down as low as \$1.85.

IMPORTATIONS OF CEMENT.

From reports of Bureau of Statistics the following are the imports of cement of all kinds into the United States for the past ten years:

Imports of Cement:

Years ending June 30.	Bbls. of 400 lbs.	Value.
1878	187.000 221,000 337.793 472.864 582,623 578.141 645,197	\$204,42° 205,074 373,601 440,025 675,587 817,346 820,008 906,581 722,579

* Estimate of Geological Survey.

CONCLUSIONS FROM THE FIGURES.

The American manufacture has remained practically stationary since 1883, actually decreasing in 1885, and increasing slightly to 1887. The price fell, however, each year so that the 4,150,000 barrels of 1885 netted less to the makers than the 3,250,000 barrels of 1882, and the ,000,000 of 1887, barely as much as the smaller output

On the other hand, the imports of foreign cement have increased tenfold since 1878, and in the period since 1882 have actually trebled.

In the last-named period the invoice price has fallen from \$1.77 in 1884 to \$1.01 in 1887, owing to taking duty off of barrel.

THE CAUSE OF HEAVY IMPORTS AND CHECKED PRO-DUCTION.

Three causes have led to the increase of imports and checked home production.

First—Low ocean freights.

Second—A practical reduction of the duty nearly one-half in 1885, by the decision of the Secretary of the

half in 1885, by the decision of the Secretary of the Treasury, relieving the foreign article from duty on the barrel and on foreign inland transportation to tide-water. Third—The higher wages paid American labor. On the first point it may be stated as a fact that the freight from Europe to nearly all tide-water points in the United States and to many lake points is less than the rates from American cement works to similar points. The reason for this is that cement comes from Europe as ballast

On the second point the figures of imports above given show a reduction of 75 cents in invoice value of cement imported from the year 1884 to 1887. This is due to the taking off the duty on the barrel, and has actually, by an executive act, without action of Congress, reduced the duty for ar to a cents per bere level. duty from 35 to 20 cents per barrel.

On the third point, in order to compete with the foreign

maker, there remains no other possibility of reducing cost except by reducing wages of labor, as the constant reduction necessary to keep a foothold since 1882 has exhausted all other margins and means, a number of failures having proven this fact. The labor is at least 50 per cent. less

COMPARATIVE LABOR FIGURES.

Cement is nearly all labor.

In the United States:

Quarrying rep	resen	its40 j	er cent
Burning	**		**
Grinding	**	6	• 6
Moving, etc.,	"	5	**
Packing	**	3	**
Coal and coke	e, sta	ves and heading, all the	
product of	labo	r represents27	"
Makin	g of l	abor 87	4.

This labor represents on an average for-

Quarrymen	\$1.50 to	\$2.00	per day
Laborers	1.30 to	1.50	**
Millers	2.00 to	2.50	••
Millwrights	2.50 to	3.00	44
Engineers	2.00 to	2.50	**
Coopers	r ro to	2.00	• •

All the labor is that of men.

In Europe.

Both men and women are employed in cement-works. The wages paid per day as gathered from investigation made in the European cement works and from Consular reports of 1884 are as follows:

	France.	Germany.	Belgium.	England.
Miners	\$0.87	\$0.52 .65	\$0.60 .881/s	\$0.52
Women Miliers	.48 to .87	.05	.88%	1.00
Millwrights	1.121/2		.831/2	1.16
Laborers	.76	.60	.66	. 78
Women Laborers	. 381/2	.24	.57	
Engineers	. 97	·73 .66	1.03	1.10
Coopers	.93	.66	.86	1.13

AMERICAN MALE VERSUS GERMAN FEMALE LABOR.

From U. S. Consular reports, Ex. Doc., 48th Cong., 464, one German Portland cement manufactory in



Silesia employed in 1884, according to its pay-roll, in its whole works:

3 workmen.at 36 cents per day.

A total daily pay-roll of \$33.72.

An American works of same number of hands employs according to its books :

2 engineeis.at \$2.00 30 coopers... .at \$1.74 4 millersat 2.50 2 millwrights....at 3.00 51 laborers at 1.30 50 quarrymen. at 1.75

A total daily pay-roll of \$226.30.

A daily difference in favor of German manufacturer and against American manufacturer of \$192.50 in labor alone. CONCLUSION.

Clearly, under these facts, the duty on cement should be retained under that clause of the Democratic platform of

1884, which says:
Necessary reduction in taxation can and must be effected without depriving American labor of the ability to successfully compete with foreign labor, and without imposing lower rates of duty than will be ample to cover any increased cost of production which may exist in con-sequence of the higher rate of wages prevailing in this country



CONGRESSIONAL BATH-ROOMS

CLEANLINESS, LUXURY, AND INSPECTION FOR THE NA-TION'S LAWMAKERS.

(From the Washington Star.)

THE bath accommodations of the House are a luxury that brings to the mind of back county constituents fairy visions of Oriental grandeur. Away down in the depths of the Capitol, down still yet below the basement, the marble tanks of tempered water into which the members plunge are located. When the elevator bumps against the plunge are located. bottom and can go down no further there are three steps with a brass rail on each side, and then you are in a little square room almost as warm as a steam bakery. A door leads into a short passage betwen the heavy foundations. Here the air is warmer than in the room. Suddenly it Here the air is warmer than in the room. Suddenly it turns at right angles into another short passage, where the thermometer registers still higher. Another turn and another thermometric jump, and there are the bath-rooms. The plural applies to the big walnut cabinets with blind doors which stand in a row along the wall. There are nine of these, and in each is a large tank or bath-tub, which can be filled with hot or cold or tepid water in a very few minutes. These are all in a narrow L-shaped room, which is presided over by a big colored man and his assistant. The cabinets or baths are about the size of assistant. The cabinets, or baths, are about the size of an ordinary hotel bed-room, and the tubs are big enough for the largest sized statesman to wallow about in with ease and comfort. Tom Reed, and Barnes, of Georgia, test their capacity more than any other members, but they even can roll over and flounder about in one of the marble tanks with as much ease as they could perform the same evolutions anywhere.

Some of the tubs are simply iron, nicely painted, but the newer ones are made of marble and each looks like a great sarcophagus. Three ordinary men might get in one of them without much crowding. The marble sides are as slippery as glass and as warm as the flesh that touches them. Thermometers are hung in each bath and on the walls in the passage. The temperature is kept always the same, and a member might promenade for three hours in nothing but his epidermis without danger of cold. It was here that Mr. Reagan struggled with a tight undershirt on the occasion of his famous bath while the vote on the

Morr son bill was being taken.

The temperature is just at a point where the least ex ertion would bring on a profuse perspiration, and but little rubbing in the bath is sufficient to bring a ruddy glow. Members come up in the elevator from these regions with the hair curling about their temples and their cheeks as pink as a baby's.

Some of the older members take a bath as the last step Some of the older members take a bath as the last step in their preparation for making a speech. They write the speech, commit it to memory, take a bath and then deliver it. If a member has the rheumatism or a cold, or for any other reason feels the necessity of being par-boiled, there is a Russian steam-bath at the end of the bath-room to which he resorts. It is a little close room furnished with a wooden bench and a coil of steam-pipes that cover the walls of the compartment. When the door shuts there can't much heat get out, and the thermometer naturally runs up into the big combinations. A member lies on the bench. into the big combinations. A member lies on the bench, the door is shut and the steam is turned on. He is then in about as hot a place as he is likely to enter in this life. He gets enough of this in a little while, and he has to be cooled off gradually by being plunged first into a tub of hot water, into cooler water, then cooler and cooler, until he gets back to the temperature of ordinary mortals. It takes about

an hour or an hour and a half's cooling before he ventures out into the colder atmosphere of the house; and it is best

for him to walk rapidly on his way home.

Members of Congress can bathe here any day, provided not more than a hundred select the same day : but on Saturday none but members can enter. On other days employees of the House, or men who have been given tickets ployees of the House, or men who have been given tickets by members, may bathe. On Friday business is most brisk, and the swashing of the water may be heard from early morning until the place is closed in the evening. It is hard to tell how many people are bathed on this day, but ordinarily a hundred is as many as can be handled "in hours." After an all-night session the capacity of the rooms is strained. Members have all their toilet made here except their barbering. The air smells moist with steam, and is fragrant with perfume and scented soaps. The very finest toilet furnishings are used. The "black man of the bath" will rub you down and perform all the services of the bath. services of the bath.

Besides this he has proper instruments for the purpose, and he will trim off the corns and keep the feet in order. When a new member is elected from a country district it generally takes "a right smart while" to get his feet in condition. They require much care and attention. But this man keeps all the Congressional feet in order without regard to size or previous condition.

THE DRAINAGE OF THE CITY HALL BUILD-ING AT ALBANY

WE saw a newspaper item alleging serious defects in the drainage of the Albany City Hall building built a few years since. We wrote to City Engineer Andrews regarding the matter, and have received the following reply:

ALBANY, N. Y., March 8, 1888.

SIR: In response to your request of the 7th inst., I will state that the origin of the article enclosed by you, which appeared in all the papers here, was as follows

One of my assistants imagined that he detected a smell of sewage in this office, which is on the ground floor, and, at my suggestion, he asked one of the inspectors of the Board of Health to apply the peppermint test. This was done by pouring a quantity of peppermint and water into a wash-bowl in the third story. In a few minutes the offices were filled with a very strong odor of peppermint. I then called upon the Street Commissioner, who is a plumber, and did the plumbing work (but did not lay the tile drains) of the building, to aid in an examination. We discovered that the immediate cause of the smell noticed was due to defects in tile pipes serving to drain the area boxes. One of these pipes had a hole knocked in it, and a very strong smell was evident at the hole; another of these tile pipes delivered a strong peppermint odor outside of the building into the area box, from whence it was immediately drawn into a window designed to supply fresh air to the building, a fan with steam coil being provided for the purpose, but not now used.

Until these defects are remedied it will be useless to test for other leaks.

The steam (return) pipes are badly rusted and leaky in places, and these are now being repaired. There seems to be a leak also in the water-pipes, or in the elevator pipes, as a constant stream of water runs through the cellar walls and over the floor. The roof of the building needs immediate and extensive repairs, as there are many leaks and much damage is being done.

A difficulty seems to exist in making small repairs when needed, for the building being in charge of County Supervisors as well as of city officials, it is very difficult to get the requisite appropriations. This is merely one of the many instances where there is no one responsible head, and where every one's business is no one's business. The defects arise from neglect mainly. As a sanitary engineer, I am most alarmed about the defective drains, and would ascribe the many headaches and small illnesses of frequent occurrence to this cause principally.

I do not wish to convey the impression that any others than my assistants and myself are alarmed, for such does not seem to be the case. The people of Albany are so used to defective drains and unventilated sewers that the matters I have referred to do not seem very alarming to them, excepting the evident damage to the externally beautiful building. Very truly yours,

HORACE ANDREWS, City Engineer.

CUP VERSUS WIPED JOINTS.

NEW YORK, March 14, 1888.

SIR: I have read with interest the discussion on the cup and wiped joint between Messrs. Kirk and Billings in your issue of March 10, and I must coincide with Mr. Bil-lings in his views. Having had twenty-eight years' experience as a journeyman and superintendent in the plumb-ing trade, I find that a cup joint, if properly made, will

stand the test of expansion in hot-water pipes better than a wiped joint, as the solder can be used on a cup joint a wiped finer and hotter than in wiping. While I have great deal finer and hotter than in wiping. While I hav seen many wiped joints stretch and crack in the middle I have no recollection of a cup joint cracking in the middle. We, as plumbers, object to the cup joint, because it don't look as well as a wiped joint, and it indicates no mechanical skill, and besides, if improperly made, it is useless.

Respectfully yours,

J. B. PATERSON.

845 EAST 164TH STREET, New York, March 10, 1888.

SIR: I thought that your correspondents in advocating the merits of the "wiped" and "cup" joints left the question without the clear line of demarkation which seems to tion without the clear line of demarkation which seems to me to define the limits of usefulness of the two joints. All of the lead solders melt at a lower temperature than lead. Generally speaking, the botter the solder is made without melting the pipe to injury the better the joint. The wiped joint is made by heating the solder to a semifluid state, when it is molded about the joint. The heat has not been great enough to make it athers. has not been great enough to make it adhere very firmly has not been great enough to make it adhere very him to the lead pipe, and it forms a metallic wrapping which shrinks tight about the pipe and resists low pressures. The ease with which it is made, even in inconvenient positions where it would be impossible to make a cup joint successfully, recommends it for all plumbing work at low pressures and justifies the waste of solder.

Any one who has had to do with joints in lead pipe at

pressures exceeding 100 pounds, and ranging from this to 400 pounds, will know how utterly worthless this joint is at such pressures. It is not necessary to make the pipe thin at the joint for the cup joint. If properly made the solder is literally melted into the lead pipe and on to the brass or copper fittings, making the joint, though some-times unsightly, still the only satisfactory one for use under high pressure, or when the conditions of tempera ture vary greatly. Yours truly, O. F. Nichols.

NEW YORK, March 15, 1888.

SIR: With reference to the discussion on cup and wiped joints between Messrs. Billings and Kirk in your issue of March to, it is my opinion that the cup joint naturally weakens the pipe by expanding it to admit another pipe of equal size, but if a smaller pipe be entered in a large one equal size, but it a smaller pipe be chicked in a swaller which requires no opening the joint will be as strong as

any part of the pipe.

In cases of frozen water-pipe that I have seen they invariably burst at the open end of a cup joint, but I never

wariably burst at the open end of a cup joint, but I neve knew a wiped joint to burst.

Mr. Billings makes a good argument in a bad cause, but is mistaken in saying that a wiped joint is a butt joint. This is not the case; one pipe enters the other the same as in a cup joint.

as in a cup joint.

A lead pipe can be no stronger than its weakest point: expanding weakens it, and if it be argued that it is still strong enough after expanding, there must be a great waste of material in making the rest of the pipe so much heavier. Therefore a wiped joint is cheapest on account of avoiding this waste.

Some years ago my attention was called to a device for cold-welding two lead pipes over a corrugated iron ferrule, which was inserted into the expanded ends and the

rule, which was inserted into the expanded ends and the pipes molded down over the corrugations and finished to a perfectly smooth joint. The same argument here used concerning cup joints was effectively used against it.

Basin-cock couplings and all small brass couplings are generally cupped in, but the pipe is usually large enough to admit the end of the coupling without expanding.

I consider a wiped joint the cheapest and best, and when properly made it is the strongest part of the pipe. A good wiped joint is also very surely made, and an inexperienced workman is least likely to make a poor joint with one since the more time he takes the more complete. with one, since the more time he takes the m MICHAEL SEXTON. the amalgamation.

HEATING SURFACE REQUIRED TO HEAT WATER IN TANK

NEW YORK, January 13, 1888.

SIR: Will you kindly inform us how many square feet of heating surface in a tank will be required to raise 21,000 gallons of water from 160° to 320° in ten hours. using steam at 80 pounds pressure, and oblige

[To warm 21,000 gallons in ten hours through the range of 160°, between 160° and 320°, is the equivalent of warm ing 17,125 pounds of water in an hour through the same number of degrees, or 2,740,000 heat units, and it calls for the condensation of 3,009 pounds weight of steam at 80 pounds pressure to water at the same temperature.

This steam must pass into the coil at a difference of something less that 5 pounds pressure-in other words, 1 pressure must be maintained in the coil of something over 75 pounds pressure if the water is to be made 320° Fab. This determines the minimum diameter of the pipe that supplies the coil; and with a volume of about 5 cubic feet to the pound weight, and a volocity of, say, 600 feet per second, it will require a pipe of fust about one square inch of area in cross-section to pass the steam required at 80 pounds.

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It must be remembered, however, that this is a very short pipe-a nipple only-and that if the pipe has any considerable length, not less than a 11/4 or 11/2-inch pipe will pass this amount. This is the size that is required to keep the tank hot when it is drawn from regularly-or, in other words, to keep the pot boiling.

A different condition, however, exists when steam is turned into a cold tank, or, rather, a coil in a cold tank, and in such a case the pipe must be large enough in diameter to pass the steam in a very much greater volume, as the pressure cannot be maintained until the water becomes very hot.

It might be well to remember, also, that the velocity will vary under this condition, as condensation takes place so rapidly in the coil, so that the increase of volume may be 5 to I, or nearly so, as the pressure reduces. It is well in practice, therefore, to consider only the increase in volume, which will make the pipe five times the area of a 1-inch pipe, or something greater than a 2-inch pipesay the next commercial size-21/2-inch. This, remember, is for a very short pipe, with no elbows, and that practically you will require a 3-inch pipe.

The coil throughout would be well to be of the same diameter, if it is a continuous spiral or return bend. If a header coil, it may be made of 1-inch pipes, with 3-inch headers.

For the surface of this coil there are no very complete data. While there is a great difference of temperature between the steam and the water, a comparatively small coil will do-about 35 feet lineal of 3½ pipe. To keep the water at 320° Fah., however, with steam only 2° or 3° hotter, presumably four times as much coil will not prove more than necessary, and if we were called upon to plan such an apparatus we would so provide that it would be an easy matter to add to the length of the coil.]

PNEUMATIC TUBES WANTED.

PENNSYLVANIA COMPANY, CHIEF ENGINEER'S OFFICE PITTSBURG, PA., March 9, 1888.

SIR: We are looking up the matter of pneumatic tubes for a large office building. Can you give me the names of any parties who make a specialty of this business, and could you refer me to your paper for a description of any of these devices which are in use for the transmission of messages from one part of a building to another, or

from one building to another building through tubes?
Yours truly,
THOMAS RODD,
P. A. Engineer.

[An illustrated description of the Pneumatic Service in the Equitable Building, New York, appeared in our issue of November 12, 1887, page 680. Our readers can doubtless suggest the names of parties making a specialty of this work.]

RECORD OF PRESSURE ON WATER-MAINS IN UNITED STATES.

New York, March 10, 1888.

SIR: Will you kindly let me know if there is a book published giving the pressure on the water-mains in different towns and cities in the United States? The idea is to find out those towns in which the pressure on the water-mains is too high for domestic purposes, and where they would therefore likely need pressure-regulating valves. Answer at your earliest convenience and oblige,

Yours respectfully,

TIMOTHY KIELEY.

[We know of no book that gives this data, but we believe manufacturers of water-motors have collected it for their private use. Maybe our readers know of available data.]

STEEL VERSUS WROUGHT IRON FOR BUILD-ING PURPOSES

BOSTON, January 31, 1888.

BOSTON, January 31, 1888.

SIR: Might I ask an opinion from your paper in regard to the use of steel for building purposes in place of wrought iron? I am engaged in the planning of a large structure involving the use of many heavy iron or steel beams, and some trusses of rather exceptional spans. In view of the impracticability in this special case of making careful tests of each piece of metal before it leaves the shop, is it safe to simply specify steel beams of given weights and brands and figure the dimensions of the members of the trusses? In other words, can the appearance of steel be trusted as an indication of its reliability for building purposes?

Yours very truly, ARCHITECT.

[Our correspondent really asks two questions: First,

[Our correspondent really asks two questions: First, as to the comparative values of steel and wrought iron for structural purposes, and second, as to the importance of

inspecting and testing such structural material before delivery at the site of erection.

As regards the comparative merits of the two metals. we may say that for ordinary purposes there is very little choice between good grades of each as supplied by reputable manufacturers.

Iron has been longer made and is better understood, and can be obtained with certainty of good quality from more people, but first-class structural steel, as made by those who have had the requisite experience in its manufacture, is a most excellent material, and we should be inclined, if able to inspect it properly, to give it the prefrence for almost all structural work.

The two metals cost about the same per pound, and as steel is about 30 per cent. stronger, and the same factors of safety are admissible for each, the same dead load can be supported with equal safety and with less expense by the use of steel. As their moduli of elasticity are also about the same, the lighter steel beam, though of equal strength, will deflect more than iron under the safe load of each.

Consequently, if the admissible deflection is limited, there is no economy in the use of steel, unless the span is so great that the weight of the structure itself becomes a large fraction of the total load, in which case the saving of weight due to the greater strength of steel may make the deflection even less than that of an iron structure of the same strength, in which case the advantage is every way in favor of steel.

As regards testing, while we will not say that good material cannot be obtained with certainty and in any quantity from reputable makers, we should not advise placing any dependence upon so doing.

The material, whether steel or iron, should, for all structures of any magnitude or importance, be thoroughly inspected and tested as soon as rolled, and its behavior and treatment should be carefully watched at every step from that point on until it is finally and satisfactorily placed in the structure.

Too much stress cannot be laid on the importance of early inspection for the interest not only of the manufacturer, but of his customer as well, for not only can imperfections be much more readily detected before the work is assembled, but a flaw for which a single bar would be unhesitatingly condemned is apt to be looked at very differently when the condemned bar would have to be cut out of a finished member. Even if the bar is cut out and replaced the member is apt to be more or less injured in the operation.

If the job is not large enough to require all the time of one inspector, a cheaper way would probably be to employ one of those engineers who make a business of such work. and who, by long experience and systematic methods, are able to exercise an efficient oversight of several jobs at once at the same mill or sometimes even at different mills.

In conclusion, we may say to our correspondent that it is never customary to test each piece of metal, or even a large percentage of them, only a sufficient number being selected for test to secure a satisfactory knowledge of the material. Every piece, however, should be carefully inspected, and the architect who should depend merely on appearances, and presumably the appearance of finished work, could be by no means certain that he was even getting steel at all.

The general question of the comparative value of iron and steel for structural purposes is altogether too large to be satisfactorily discussed in this brief comment, and we should be glad to publish the views of those of our readers who can speak from experience.]

ADDRESS WANTED.

OFFICE OF THE Spring Hill Water Company, Seattle, Wash. T., March 1, 1888.

SIR: Please give me the name and address of parties manufacturing the Deacon meter, Bell's waterphone, and Church's indicator, mentioned on page 35 of your book, Water-Waste Prevention.

Yours respectfully. E. SHEPARD, Manager.

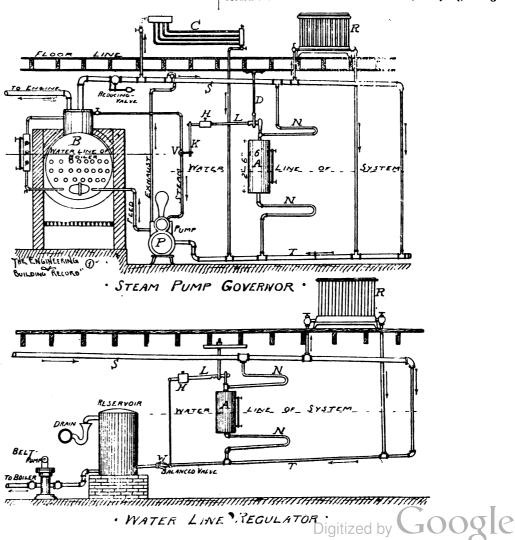
[The representative of the Deacon meter in the United States is S. A. Strang, 30 Pine Street, New York. We have not the address of the other parties. Possibly our readers can furnish it.]

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patenties, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any ofter of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

PUMP-GOVERNOR AND WATER-REGULATOR.

THE device which we illustrate herewith is designed to maintain a uniform height of water in the return-pipes of a steam-heating apparatus. This is accomplished either by controlling the action of the pump, if one is used to return the condensed water to the boiler, or by regulating



the outflow of the condensed water from the return pipes. Its action will be readily understood by reference to the illustrations. It consists primarily of a tank A suspended from the short end of a lever L, to the long end of which is connected the arm of the throttle-valve V of the pump or of the outflow-valve W on the return-water main.

This tank is connected to the return-water system by flexible pipes N N, which permit some vertical movement.

When there is an excess of return water its additional weight in the tank causes the tank to preponderate and raises the long end of the lever, which by suitable connection opens the throttle-valve of the pump, which then pumps out the condensed water until the tank is so far lightened that the counter-balance weight on the lever preponderates and by its descent shuts off the steam again.

Its operation in controlling the outflow-valve is precisely similar and will be readily understood from the above description.

The height of the water-line can be kept at any point within the range of the tank by adjusting the position of the counterweight on the lever or by shifting the position of the lever on its fulcrum by means of the notches on its under side or both.

The device may be used to control the height of any sort of fluid in reservoirs and under any pressure by regulating either the inflow or the outflow or both. If not under pressure only the lower connecting pipe N will be necessary. If attached to a steam-boiler it can be used as a feed-water regulator.

Mr. P. Gormly, 155 North Tenth Street, Philadelphia, manufactures this apparatus.

The patentee is Mr. H. W. Brinckerhoff, of 41 Jefferson Avenue, Brooklyn, N. Y.

BROOKLYN BRIDGE TERMINAL PLANS.

MESSRS. WALTER KATTE, Julius W. Adams, and Joseph Crawford, Board of Experts selected by the bridge trustees about a year ago to report on the different schemes submitted to secure better terminal facilities at the New York end of the Brooklyn Bridge, have made a report recommending as the best of all those submitted to them the plan presented by Mr. A. M. Wellington, Mem. Am. Soc. C. E.

Briefly stated, Mr. Wellington's plan, certain features of which are patented, contemplates the following:

To spread the two cable tracks a little at each end, and connect them by a horseshoe curve of ninety feet radius extending nearly to the street line of Park Row.

To enclose under one roof the entire terminal horseshoe thus formed. A station similar in essentials to be erected To run trains of eighteen cars (less, of course, until all

are needed) into this station, which, when stopped, shall completely fill the stations in horseshoe form, with head and rear cars opposite each other.

and rear cars opposite each other.

Entrance to train to be from inside platform only; exit to the outside platform only. The cars to have entrance and exit doors arranged in a peculiar way to facilitate quick loading and unloading on either the curved or arranged to the curved or straight track.

The extreme dimensions of the proposed building of horseshoe form are 434 feet long by 288 feet wide.

The roadways are carried within the building in covered

The roadways are carried within the building in covered ways twenty feet wide, as now. This enables the toll-gates to be under cover, and utilizes the space above the roadways as additional platform space for the upper tracks, where it is most likely to be needed.

The building is widened slightly at the easterly end, so as to obtain some desirable platform space and bring its side parallel with Frankfort Street. The entire small triangle of buildings be ween the bridge on the north, and Frankfort Street on the south must practibe acquired

The station is to terminate at the west end in a large The station is to terminate at the west end in a large rotunda, which is the principal feature of the building. The rotunda floor is separated from the loading or outgoing platform, and this fence is continued parallel to the track along the entire 900 feet of track within the building. In this fence are placed eighteen or more ticket wickets approximately opposite to the central entrance door of each car, the windows for sale of tickets being at some interior point. sale of tickets being at some interior point.

By these arrangements the entrance to the outgoing platform is from the side at all points instead of from the

The diameters of the rotunda, etc., are roughly as fol-

Rotunda proper, constituting the beginning of promenade, as well as an entrance space for car passengers, and bounded on the outside by fence to outgoing plat-

Dounded on the same of terres to the grand plant		
form	135	feet.
Centre line of track		
Outside of incoming platform, at centre of rotunda		
Outside of roadways, at centre of rotunda		
Extreme width of building, west end	288	feet.
E	*6-	fast

THE NEW YORK ARCHITECTURAL LEAGUE ON THE GRANT MONUMENT COMPETITION

On Thursday, the 15th inst., a Committee of the Architectural League consisting of Messrs. Warren R. Briggs, E. H. Kendall, Henry J. Hardenberg, F. A. Wright, Clarence S. Luce, and the President of the League, Mr. John Beverley Robinson, presented the following memorial, as ordered by the League at its last meeting, to Ex-Governor Alonzo B. Cornell, Chairman of the Executive Committee of the Grant Monument Association:

To Alonzo B. Cornell, Chairman, and the members of the Execu-tive Committee of the Grant Memorial Association:

tive Committee of the Grant Memorial Association:

The Architectural League of New York herewith enters protest against the terms of your circular invitation to competitors for the Giant Monument bearing date January 26, 1888.

In its opinion many of the conditions as therein set forth are, by eason of their indefiniteness and ill-judged nature, such as will not titract designers of repute, and it would more specifically call your attention to the following sections of your circular.

(1) To Section 2, in which the proposed cost of the monument is not stated with that assuredness and authority that will place competitors upon equal terms, the amount to be expended being prac-

(1) To Section 2, in which the proposed cost of the monument is not stated with that assuredness and authority that will place competitors upon equal terms, the amount to be expended being practically left to the judgment of each.

(2) To Sections 5, 6, and 8, which permit designs to be submitted at different scales, one-quarter and one-cighth inch to the foot, in different mediums, line and "washed" or brush-made drawings, and in different materials, drawings or models.

To put competitors upon an equal footing, there should be but one scale to which designs should be made, and but one manner in which they should be exhibited, and to this one scale and one manner all should be bound. It has been found that a scale of one-cighth or one-sixteenth inch to one foot is sufficiently large to afford opportunity for the exercise of the most critical judgment and pure line drawings, in pen and ink, the most fair media of representation.

The precise nature and quality of sculpture should not be and is not now to be considered, its purpose and general intent being as well shown by drawings as by models.

(3) To Section 17, which, not he opinion of your memorialists, is the most faulty of the provisions. To request competitives to underbid each other in the price of their services is not the way to secure the best talent.

In conclusion, the Architectural League of New York has entered

most faulty of the provisional each other in the price of their services is not the way to secure the best talent.

In conclusion, the Architectural League of New York has entered this protest wholly and only with the desire to point out to your committee the faults in your circular which may render null your efforts; and to urge upon you the advisability of so amending your conditions that the best result may be reached in the best, most expeditious, and most fair manner.

In pursuance of the latter desire it presents for your consideration a copy of the Instructions to competitors for the Indiana State Soldiers' and Saitors' Monument, which it considers a model in completeness and fairness, and which competition has been brought to a most satisfactory and successful conclusion.

ENGINEERS' CLUB OF PHILADELPHIA.

THE business meeting of this club was held March 3, 1888, President Joseph M. Wilson in the chair; 34 members and 3 visitors present.

Rules to facilitate the discussion of papers, as formulated by the Publication Committee, were submitted by the Secretary, discussed, completed as to limit of time of submission to Publication Committee, and as to number of copies to be furnished to author, and, on motion of the Secretary, adopted.

The following were elected:

Active Members-Messrs. James G. Davidson, Edwin S. Crawley, Theodore Kolischer, James B. Best, Frederick Stamm, William D. Janney, Gustav Bottiger, R. I. D. Ashbridge, John Baptist Nau, S. Pemberton Hutchinson, and Joseph D. Potts. Associate Member-John Gordon

Mr. Morris P. Janney described an electric water-level indicator for steam boilers, exhibiting a specimen arranged so as to work as when in actual operation.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met March 7, 1888, President Holman in the chair, W. H. Bryan, Secretary; twenty-nine members and five visitors present.

The report of the committee on the Waddell pamphlet The report of the committee on the Waddell pamphlet on "Highway Bridges" was taken up. After a general discussion, participated in by Professor Johnson, Colonel Moore, Professor Engler, Messrs. Seddon, Bouton, Wheeler, and others, the following substitute was adopted:

"Kesolved, That the Engineers' Club of St. Louis do not day it advisable to endorse any individual coefficients."

deem it advisable to endorse any individual specifications."

The secretary read a letter from Samuel J. Randall,

acknowledging receipt of the club's resolutions on self-

registering rain-gauges in signal-service stations.

The president formally announced the death of Fredappointed a committee to draft resolutions. Professor Potter, late president of the club, having been elected to the presidency of the American Institute of Mining Engineers. neers, it was voted to tender a complimentary banquet at such time and place as would suit his and the club's convenience.

Professor Gale then read a paper on "Transmission of Professor (ale then read a paper on "Transmission of Power by Belting," giving the results of some recent experiments; also a formula for calculating the width of belt for a given power. An empirical formula, which had been found correct up to 5,000 feet belt speed per minute, was given. Results of tests of various kinds of belts on iron and lagged pulleys were also given. Samples of the belts tested were shown.

ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting was held in the club room March 5, 7:45 P. M., T. F. Winne in the chair, and Kenneth Allen, Secretary, ten members and seven visitors being present.

A letter to the Committee of National Public Works from Mr. John Eisenmann, Secretary of the Council, requesting action to be taken by the club was read, also one from E. L. Corthell, Esq, President, thanking the Committee Council their liberal subscription to defray expenses of the Council.

The report to the Council on the Cullom Bill by the Kansas City Committee was read, and a report by the same committee to the club, in which it was recom mended that the club pass resolutions to endorse the said bill, and that they co-operate with the other societies in promoting it.

The report was adopted, and the resolutions endorsing it, which were read at the previous regular meeting, were

The club also, on motion of Mr. Kiersted, passed resolutions urging national appropriation for placing self-registering rain-gauges in all parts of the country, to record rainfall, as recommended by the Chief Signal

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company Knickerbocker Gas-Light Company Gas-Light Company Company
March 10	25.05	19.67	20.61	29.68	27 78 22.47 30.14

PERSONAL.

COLONEL G. W. M. MORSE, the inventor of the Morse cartridge and breech-loading gun, died at his home in Washington, March 8.

It is reported that M. Felix de Lagarde, engineer and Chief of the Second Division of the Panama Canal, died in Panama on February 27.

C. A. SEDORSTADE, C. E., of Philadelphia, Pa., has taken charge of the construction of the Simpson dry-dock at the Norfolk Navy Yard under the direction of Civil Engineer M. T. Endicott, U. S. N.

CAPTAIN SMITH S. LEACH, of the Engineer Corps of the Army, will succeed Captain Eugene Griffin, under the Engineer Commissioner of the District of Columbia. Captain Leach is a member of the Mississippi River Commission.

MESSRS. CHARLES D. CRANE and Charles Barkhausen, for many years with E. T. Mix & Co., have opened an office on Wisconsin Street, Milwaukee, and will do a general business as architects. Mr. Crane has superintended the erection of many of the large buildings erected by Mix & Co. during recent years.

CAPTAIN ROBERT W. HUNT, who recently resigned as General Superintendent of the Troy Steel and Iron Company, has established a bureau of inspection, tests, and consultation, under the firm name of Robert W Hunt & Co., with principal office in Chicago and branch offices in Pittsburg and New York. He has also become a member of the firm of G. W. G. Ferris & Co., civil engineers and inspectors of iron and steel, in Pittsburg, Pa.

MR. HENRY M. CONGDON, architect, of New York, has been selected to furnish the plans for Grace Cathedral, to be erected at Topeka, Kan., at a cost of \$100,000.

ARCHITECTURAL COMPETITIONS.

COURT-HOUSE COMPETITION, MINNEAPO--The committee has employed Architect W. Boyington, of Chicago, as expert to advise them regarding the merits of the different designs received for the new court-house and city hall. List of competitors noticed in our issue of February 25.

MISCELLANEOUS.

ALBANY, N. Y .- The Governor has signed the bill appropriating \$185,000 for a new asylum for insane criminals at Matteawan.

CHIPPEWA FALLS. WIS - Fifteen acres have been presented by Donald McDonald to Chippewa Falls. Wis, for a public park. Work is to be commenced on it soon.

BROOKLYN, N. Y.—The steeple of the Classon Avenue Presbyterian Church was destroyed by the recent storm and will have to



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WE have a large quantity of important news of projected buildings from various parts of the United States which we are obliged to omit, owing to the lateness of its receipt, on account of the storm.

WATER, SEWERAGE, ETC.

WATER, SEWERAGE, ETC.

New York CITY.—The Municipal Council of Callao, Peru, invite sealed proposals for supplying the port with water-works and construction of drains to improve the hygiene of the place. Full particulars and conditions can be obtained at this Consulate, No. 39 Broad Street. The bids will be opened in Callao, June 26, 1888.

This reported that the civil authorities of

It is reported that the civil authorities of Brussels, Belgium, have offered prizes for plans for a municipal water-works system.

ALBANY, N. Y .- At a recent meeting of ALBANY, N. Y.—At a recent meeting of the board of old and new water commissioners the plans for locating the three 5.000,000 gallons each pumps at the driven well flats, and conducting the mains through the fields, as proposed by Engineer Fteley, of New York, to whom the matter was referred, were adopted, to whom the matter was referred, were adopted. to whom the matter was referred, were adopted, with certain reservations. The three months' test of the driven wells by the Messrs. Andrews, contractors, had been delayed somewhat by increasing the supply required by one-half, or to 15,000,000 gallons. At the expiration of the time set the three engines ordered by the old commission will have been expiration of the time set the three engines ordered by the old commission will have been ready to be erected, and provided the trial has ready to be effected, and provided the trial has been satisfactory, the work of constructing buildings and effecting the engines and pumps will be proceeded with immediately. The new commission proposed to add an additional engineering commission proposed to add an additional engine and pump of 5,000,000 gallons capacity to the three of like capacity ordered by the old board to the plant on the flats, but after discussion it was thought best to hold off until the test was completed. It was also recommended that in the event of the water in the mended that in the event of the water in the driven-wells being found inexhaustible, the engine on Montgomery and Quackenbush Streets, now used in sending Hudson River water to the reservoir, be remodeled and placed on the flats at an estimated cost of \$20,000 to \$30,000.

WACO, TEX.-It is reported that the City Council has been endeavoring for the past two years to get the Waco Water Company to accept a contract which that body considered equitable and just, one that would give the equitable and just, one that would give the city ample protection against fire, but failing to do this the Council at its last meeting passed a resolution ordering that cisterns be built over the city for protection for use when the present contract with the Waco Water Company expires on the 6th of July next. A meeting of a number of the largest taxpayers in the city was held March 9, and resolutions were passed condemning the city results. were passed condemning the cistern system, and a committee was appointed to confer with council, and if it was found that no just con-ract could be made with the Waco Water company, that the Council be advised to issue conds and build its own works.

HUNTINGTON, PA.—A water company has even formed here and it is reported that works vill be built this summer.

HUGOTON, KAN. — Our correspondent vrites: "This place will vote \$6,000 bonds on larch 16 for water-works and general imtovements for the city. Our city intends to ut in a good system which will cost some 50,000."

ATCHISON, KAN.—Mr. Fred. Giddings, ity Engineer, writes: "The Council have stered into contract with Messrs. Rosewater Christie, of Omaha, Neb., to design a sysm of sewerage for the city. The preliminary vels have been taken and they are now enged in platting the city and putting on ontours."

HARPER, KAN.—It is reported that the wn authorities have refused to accept the aler-works constructed for it by Mr. John J. Hill

GLENS FALLS, N. Y.—Reports say that new ater-mains are to be laid here, also that ten iles of extensions will be constructed.

NEW LONDON, WIS.—Reports say that a ater-works system will be erected here.

PARIS, Ky.—The water-works question was before the City Council again, and sealed was before the City Council again, and sealed proposals received and opened from the Davenport Company, of Charleston, W. Va., who propose to furnish 65 fire-plugs at \$2,500 per year rental; Thompson, of Bradford, Pa., 75 plugs at \$2,500, and Cosby & Glenn, New York, 55 plugs at \$3,750. A committee was appointed by the Council to take the proposition under advicement. tion under advisement.

ONEIDA, N. Y.—The sewer question continues to occupy the attention of the citizens of this place. Emil Kuichling, of Rochester, N. Y., has considered the plans submitted by Engineer Randoll and has suggested some changes in the systems proposed. Mr. Kuichling's estimate of the cost is \$93,000. The committee will have a formal report from him and will submit it to a publ c meeting. Engineer W. F. Randall will co-operate with Mr. Kuichling making the new plan.

JOLIET, ILL.—After seven years of litigation between this city and the Water-Works Company over the valuation of the latter's plant, which the city is to purchase, the question has been left to a board of arbitrators, who will meet in Chicago April 19.

STONINGTON, COSN.—The Mystic Valley Water Company has made a proposition to supply this place with a water-supply for fire purposes and for the people. The water is to be obtained from a reservoir to be established, with 2,000,000 gallons capacity, and also to place 42 hydrants throughout the streets. The matter is to be settled at a meeting to be held at a later date.

COLUMBUS, O .- At a recent meeting of the general committee appointed to secure from the Legislature the right to use the Columbus feeder or canal for an intercepting sewer, and to secure permission to issue bonds for the building of said sewer, the sub-committee appointed to draft bills reported two bills, the first to authorize the city of Columbus to borrow money to pay for the building of an intercepting sewer, and the second authorizing the city to enter into and occupy a part of the Columbus feeder and Ohio Canal, for sewerage and street purposes. Mr. Marble, the City Engineer, stated that there are two routes that each be used, one in and one out of the that can be used, one in and one out of the freeder, but that it would be a saving of \$200,000 to the city to build the sewer in the canal. The health of 90,000 people and the removal of a burden from the State was thought to be sufficient cause for the State to give up the feeder, and it settled that the abandonment of the canal to the four-mile lock should be asked. It was decided to ask the right to issue \$500 ooo worth of bonds and to proceed with the work as soon as possible.

Avon, N. Y.—Proposals will be received by the Board of Water Commissioners of the village of Avon, N. Y., until 12 o'clock M. of March 29, 1888, for the material and labor required to construct water-works for the village.

SALISBURY, MD.—Dr. L. S. Bell, Secretary Salisbury Water Company, writes as follows: "Our company has been incorporated with \$50,000 capital stock. We propose laying about three miles of pipe, and will put in 500,000-gallon pumping-engines, stand-pipe 12x100 feet."

MORRISONVILLE, ILL.—Reports say that the people of this place have decided for a system of water-works to cost \$5,000.

BEATRICE, NEB.—It is reported that the date for the election to decide for or against water works for this place is to be March 20, It is proposed to purchase a Jewell waterpurifying plant to cost \$10,000.

MORRISONVILLE, ILL.—Mr. W. E. Forbes writes us: "The proposed water-works of our village are to cost between \$5,000 and \$7,000, to be wooden tank and substructure 60 feet high, 1,150-barrel wooden tank, four firedrants, iron pipe, engine-pressure. Works to be built as soon as contract can be let. Bids will be received all this month. Specifications will be sent to all parties that want to figure on

ALLEGHENY, PA .- The Allegheny Water Committee has decided to purchase two 5,000,000 pumping engines to take the place of the old ones, which are to be sold.

CASSOPOLIS. MICH.—It is reported that a stand-pipe will be erected here.

UHRICHSVILLE, O .- Reports say that a water works plant is to be established here.

SCHWENKSVII.LE, PA .- Reports say that a water-works will be established in this place.

PALMYRA, N. Y.—James Bourne, Jr., Town Clerk, writes us: "There is nothing being done here in relation to the establishment of water-works."

BRADDOCK, PA .- A. S. Brubaker writes us: "No steps have as yet been taken to improve our water-works."

BALLSTON, N. Y .- It is said that extensive improvements are to be made to the water-

TECUMSEH, NEB.—Bids for the construction of a system of water-works at this place after plans by A. Richardson & Co., of Lincoln, Neb., will be opened March 29, 1888.

BRIDGES.

THE Wabasha Bridge and Ferry Co., of Wabasha, Minn., has been incorporated. The object is to build and operate a bridge across the Mississippi at Wabasha. The capital stock is \$20,000. The first board of directors is composed of J. Buisson and others.

IT is reported that Bay County, Mich., will spend some \$58,000 on stone roads and \$75,-000 for bridges, as result of recent elections.

NEW YORK CITY .- The Board of Estimate and Apportionment has authorized the issue of \$250,000 for the completion of the new bridge over the Harlem River now in course of con-

INDEPENDENCE, Mo.—The County Commissioners will build an iron bridge, 165 feet span, at Big Blue, Mo. Address P. H. Grinter, County Surveyor.

HARTFORD, CONN.-It is reported that the New York, Providence and Boston Railroad Company has decided upon the plans for the great railroad bridge across the Thames River from New London to Groton. The bridge will begin on the west bank at a point some distance above the city of New London, where the river is somewhat narrower than it is at the ferry. An attorney for the railroad company is now purchasing land for the approaches to the bridge, and it is reported that the work will begin this season.

GAINESVILLE, ALA. — Our correspondent writes as follows: "An appropriation has been made by the court of County Commissioners of Sumter Co., Ala., to build a bridge across Noxubee River, near Gainesville, but, as it is a navigable stream permission from as it is a navigable stream, permission from the Government will have to be obtained, or an act of Congress condemning said stream as a navigable one, before the bridge can be erected."

MINNEAPOLIS, MINN—Bids were opened on March 7 by the Council Committee on Roads and Bridges for the stone substructure and the superstructure of the bridge to be built on Lyndale Avenue over the railroad tracks. Six bids were received for the stone, of which the Minnesota Stone Company, of this city, is the lowest bidder. Eight bids for the super-structure were received, varying from \$19.515 to \$24,056. The lowest is from the Canton Bridge Co; but before the committee can recommend any bid the plan submitted by the bidders must be examined to see if they come up to the specifications furnished by the City Engineer. Following are the totals of the

Bids for stone-Baxter & Sons, \$6,703.07; Minnesota Stone Company, \$6,185.65; Thos. Daley, \$6,868.68; George McMillan & Co., \$6,596.10; Ring & Tobin, \$6,876.34; Douglas & Co., \$6,504.22.

For the superstructure— Canton Bridge

Company (two bids), \$19,515, \$20,608; King Iron Bridge Company, \$20,393; Sheffler Bridge Company, \$22,246; A. Y. Bayne & Bridge Company, \$22,240; A. Y. Bayne & Co., \$24,056; Milwaukee Bridge Company, \$23,069.24; Kansas City Bridge Company, \$23,750; Smith Bridge Company, \$21,000; C. P. Jones, \$21,736.23.

RAILROADS CANALS ETC.

MASON CITY, IOWA.—The contract for building 170 miles extension of the Chicago, Milwaukee, and St. Paul, from Chamberlain, Dak., through the Black Hills, has been awarded to Major Allen.

WILMINGTON N C -This city has voted WILMINGTON, N. C.—This city has voice to subscribe \$150,000 to secure the extension of the Cape Fear and Yadkin Valley Railroad from Favetteville to Wilmington. Work will of the Cape Fear and Vadkin Valley Railroad from Fayetteville to Wilmington. Work will begin at once and it is expected that the road will be running into Wilmington by the first day of January next. At the same time \$100,000 was voted in aid of the Wilmington, Winslow and East Carolina Railroad, which is now being built frem New Berne to Wilmington.

THE Arizona Central Railroad was incorporated recently at Phænix, Ariz, to build lines from Phoenix to Prescott, aggregating 400 miles. The capital stock is \$7.500,000.

STREET-WORK AND PAVING.

SAVANNAH, GA.—Matthew Hayes, of Jack-sonville, Florida, is to get the contract to pave New Houston Street, between Whittaker and Drayton Streets, with cypress blocks, which he guarantees free from sap, at \$1.20 per square yard—85 cents to be paid when the paving is completed and 35 cents at the end of ten years if the paving is durable.

GAS AND ELECTRIC-LIGHTING.

LOWVILLE. N. Y., March 9.—A special meeting of the Board of Trustees was held March 8, at which time the resolution previously adopted in relation to electric lights was annulled, and the following adopted: "Resolved, that whereas the Lowville Electric Light and Power Company (limited) have offered to make a contract with the village of offered to make a contract with the village of Lowville to light the streets of said village for a term of one year with the American system of electric arc lighting, with 21 arc lights of 2,000 standard candle power, (same as the sample lights in operation on the streets at the present time), to be kept burning every night from dark until midnight, for not less than 112 nights and 265 nights if necessary for 312 nights, and 365 nights if necessary, for the price of \$1.200 for 20 lights, and one light to be maintained free; said lights to be lo-cated by the Board of Trustees; that it is to the interest of said village to make such contract, and that the sum of \$1,200 be raised by tax upon the taxable property of the viliage for the purpose of making such contract for lighting said streets by said system for one year." The matter will be voted upon at the annual charter election March 20.

CANAJOHARIE, N. Y .- The electric light question is being agitated here.

RICHFIELD SPRINGS, N. Y.—It is reported that an electric-light plant will be established

LEOMINSTER, MASS. -- An electric-light company has been organized here with E. A. Bushington as president.

WABASH, IND.— The Wabash Electric-Light Company has offered to light the city. 130 lights are to be furnished at an annual cost of \$3,200. It is thought that the offer will be accepted.

FORT SMITH, ARK.—At a recent meeting of the Board of Public Affairs the following ordi-nance was passed: The Fort Smith Gas Light Co. shall furnish the city 100 additional lamps for the remainder of the time its original contract has to run at \$27.50 per 1,000 cubic feet per annum; the sixty-three lamps now in use per annum; the sixty-three lamps now in use shall remain at the present price. \$30 each, per year; that after May I consumers shall be furnished gas at a price not exceeding \$2.50 per I,000 feet; that the Ioo additional lamps shall be put up by May I; that by November I it will increase the capacity of its works so as to make them sufficient to supply a city of 25,000 population. The lamps are to be lighted every night when the moon is not actually shining. The Board of Public Affairs is authorized to make such a contract with the company which will be given ten days in which to sign it.

BIDS OPENED

PITTSBURG, PA.—Messrs. Riter & Conley, of this city, have the contract for constructing the iron buildings for the tube-works at Find-



GREENBUSH, N. Y .- The following bids for material to be used in the construction of sewers were opened March 8:

_	<u>-</u>		
	William J. Halpen, Albany Dewitt A. Fuller, Albany Knowler, Taylor & Anderson, East Liverpool, O. Charles Millar & Son, Utea Carpenter & Woodruff, Troy William N. Calender, Greenbush C. O. Yares, Schenectady. John McEncroe, Schenectady.	BIDDERS.	
	1 65 5 1 65 5 1 62 6	3,800 feet of 20-inch. Per toot.	
	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	400 feet of 18-inch. Per foot.	SEWER PIPE
1	7778 8937.5	4,450 feet of 15-inch. Per foot.	R 2
	0 3 4 4 4 6 6 5 5 C	3,300 feet of 12-inch. Per foot.	PE.
	33 33 33 33 33 33 33 33 33 33 33 33 33	24,300 feet of 10-inch. Per foot.	
	27 22 27 27 27 27 27 27 27 27 27 27 27 2	1,500 feet of 8-inch. Per foot.	
	* n+ + + on &	500 feet of 6-inch. Per foot.	DRAIL TILE.
		400 feet of 4-inch. Per foot.	EZ
	20 8 1 8 1 8 9 9 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	400 bbls. Rosendale Cement. Per bbl.	
	** ******	70,000 lbs. Special Castings. Per lb.	
-1	<u> </u>	r80,000 lbs. Cast-iron Pipe. Per lb.	
	15 0 25 0 30	to Set stones for Catch-Basins, Each,	
-	3 - 3 + 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 Flush Tanks. Fach.	
1	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Fittings for 46 flush-tanks. Each.	
	4	150 feet bluestone. Per foot.	
	22.55 35.53 22.55 35.53 22.55 35.53 25.55 35.53 25.55 35.55	8,000 lbs, of wrought iron.	
		Per pound.	
.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Lead. Per pound.	! !
	9 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	101	
	27,310 28,765 28,805 27,792 27,310 26,645	JV.	
	8 \$ 8 8 8 3 3 8	· · · · · · · · · · · · · · · · · · ·	l

The following were the successful bidders in the different sections for construction: Section 4, Adam Miller, Saratoga, N. Y., \$10-350.50; Section 5, Adam Miller, Saratoga, \$11.327; Section 6, Adam Miller, Saratoga, \$10.658.50.

PHILADELPHIA.—Bids were opened by the Board of Port Wardens for dredging docks. The American Dredging Company offered to do the work for forty-three cents per cubic vard, and to place the material upon land, or for twenty-seven cents the dredged material to be deposited in the river behind dykes. The bids were rejected as excessive, and the matter ordered to be readvertised.

BROOKLYN, L. I.—The following proposals were opened March 6 for constructing sewers in Map O, Drainage District No. 37, Subdivision No. 29: John G. Bogert, 48-inch brick sewer, per running foot, \$4; 36-inch brick sewer, \$3.25; 30-inch brick sewer, \$3; 15-inch cement-pipe, \$1.25; 12-inch cement-pipe, 95c.; each maphole. complete. \$34: each street hasin manhole, complete, \$34; each street basin, complete, \$05. Daniel J. Creen, 48 inch brick sewer, per running foot, \$3.25; 36-inch brick sewer, \$3.25; 30-inch brick sewer, \$3.25; 15-inch cement-pipe, \$1.30; 12-inch cement-pipe. oc.; each manhole, complete, \$33; each street basin, complete, \$98. James F. Gillen, 48-inch brick sewer, per running foot, \$5; 36-inch brick sewer, \$3.80; 30-inch brick sewer, \$3.15; 15-inch cement-pipe, \$1; 12-inch cement-pipe, 95c.; each manhole complete, \$33; each street basin, complete, \$100.

MILWAUKEE, WIS .- The following bids were opened March 6, 1888, to construct and erect the engine foundation, engine pit, pump-wheel foundation, gate wells, manhole, and a section of the flushing conduit for the Milwaukee River flushing tunnel pumping works on the beach of Lake Michigan, opposite the foot of Dane place, in the First Ward of the city of Milwauke: W. T. Casgrain & Co., \$23,275; J. H. Kearney, \$18,325: Wm. Forrestal, \$17,975. The contract let to Wm-

Boston.—The City Engineer, on March 14, received the following proposals for rebuilding the sea-wall on the Roxbury Canal: H. H. Pike & Co., \$9,697; Collins & Ham, \$9,369.50; H. W. Phillips, \$8,263.50; McInnis & Parker, \$7,528.50; Boynton Bros. \$6,349; C. T. Denz & Co., \$6,065; T. A. Power of the Construction Construction Rowe, \$5,784.50; Metropolitan Construction Co., \$5,735; Charles H. Edwards, \$5,427.50. The contract was not awarded.

The Boston Water Board on March 12 received the following bids for a wrought-iron tank on Breed's Island for the high-service supply in East Boston: Whittier Machine Co., Boston, \$2,696; Samuel & Molloy, Lowell, \$3,213; Tippett & Wood, Phillipsburg, N. J., \$3,275; Ryan & McDonald, Waterloo, N. Y.. \$4,350; Riter & Conley, Pittsburg, Pa., \$3,885; James Russell & Sons, South Boston, \$3,195; Cunningham Iron Works, Charleston, \$2,800; George Miles, South Boston, \$2,420; H. L. Robinson, East Boston, \$2,779; Edward Kendail, Cambridge, \$2,625; E. Hodge & Co., East Boston, \$2,496 Atlantic Works, East Boston, \$2,975; King Iron Bridge Co., Cleveland, O., \$3,728. The contract was awarded to George

GOVERNMENT WORK.

CHICAGO, ILL.—The following tids for tie rods, etc., for repairs to attic story of Custom House were opened March 5 by the Super-vising Architect of the Treasury Department:

Joseph Downey, \$6,983; Hollingsworth & Coughlin, \$9,975; William Mansan, \$9,975; E. F. Gobel, \$9,335; E. R. Brainerd, \$10,887.

TERRE HAUTE, IND.—The following bids for material, tools, and labor for plumbing and for material, tools, and labor for plumbing and gas fitting for the Post Office were opened March 2 by the Supervising Architect:

D. W. Watson & Son, \$3,379: A. J. Gallagher, \$2,674.50; J. F. Dalton, \$2,670; Crook,

Horner & Co., \$2,825.

SAN ANTONIO, TEX.—The following bids for erecting and enclosing superstructure in masonry, iron, carpentry, and roof work of Court-House opened March 6 by the Supervis-ing Architect of the Treasury Department: Dumesneil & Bro., \$125,600; McCarthy & Baldwin, \$104,354.50; George W. Corbett, \$125,000; Branden & Andison, \$97,350; Samuel W. Swift, \$98,000; Boettler & Sindahl, \$125,000; Branden & Andison, \$97,350; Samuel W. Swift, \$98,000; Boettler & Sindahl, \$125,000; Panby & Dielman, \$111,000; Gus Wilke, \$105,000; W. S. Pleasants, \$116,000; P. T. Shields, \$105,300; John O'Connor, \$176,287; F. H. Mickey & Sons, \$116,300.

THE following bids for an electric fire-alarm call and patrol system were opened in the Treasury Building, Washington, D. C.,

John R. Galloway, Washington, D. C., \$3,200

J. N. Burket, Washington, D. C., \$2,-

The Electric Fire-Alarm Co., Evart, Mich., \$4,343.

Pierce & Jones, New York, \$3,000. Royce & Mareau, Washington, D. C., \$1,-

MANCHESTER, N. H .- The following bids for iron beams and terra cotta arches for sec-ond and attic floors of the Post Office were opened March 5 by the Supervising Architect

the Treasury Department: Sargeant & Sullivan, \$7,000; Head & Dowst,

PROPOSALS.

(Continued from page viii.)

STEAM FIRE ENGINES.—Proposals are wanted to New York City, until March 28, for furnishing two econd size steam fire engines with boilers of the "La France's improved nest tube" pattern. Address the Board of Commissioners of the Fire Department, Nos. 57 and 159 East Sixty-seventh Street.

RESERVOIR—Proposals are wanted at Columbia, S. C., until March 26, for the construction of a reservoir, according to specifications. Address William J. Catheart, City Cierk and Treasurer.

ROCHESTER, N. Y.—The Genesee Valley Club will erect a \$40,000 club-house from plans made by Messrs. Fuller & Wheeler, Architects, of Albany. N. Y.

BRICK SCHOOL-HOUSES.—Proposals are wanted at Pittsburg, Pa., until April 4, for the erection of two brick school buildings. Address James N. Campbell, architect, Room 814, Penn Building, No. 708 Penn Avenue, as above.

HOISTING ENGINES.—Proposals are wanted at Zanesville, O., until April 2, for furnishing and delivering three boisting engines for use on the improvement of the Musking run River. Address Lieut. L. H. Beach, Corps of Engineers, as above.

IRON DRIFT BOLTS.—Proposals are wanted at Zanesville, O., until April 2, for furnishing, etc., 60,000 pounds of iron drift bolts. Address Lieut, L. H. Beach, Corps of Engireers, as above.

WROUGHT - IRON WORK. — Proposals are wanted at Zanesville, O., until April 2, for furnishing and delivering thirty-eight sets of wrou ht iron anchorages for locks on the Mussingum River. Address Lieut. L. H. Beach, Corps of Engineers, as above.

STEAM-HEATING, ETC.—Proposals are wanted at Louisville, Kv., no date specified, for furnishing the sewer pipes, plantering, inon work, steam heating, boilers, plumbing, wire work, and water service, including pumps, etc., for the West Tennessee Hospital for Insane. Separate proposals will be received for each class of work. Address McDonald Brothers, architects, as above.

ELECTRIC-LIGHT PLANT.— Proposals are wanted at Jackson, O. until March 21, for an electric-light plant, to include 30 arc and 600 incandescent lights, 90-power engine and boilers. Address the Mayer.

SHOPS.—Proposals are wanted at Decatur, Ala., until March 24, for the erection of new shops for the United States Rolling Stock Co. Address the com-

PUBLIC LIGHTING.—Proposals are wanted at New York City, until March 26, for furnishing the gas or other illuminating material, and for furnishing, operating and maintaining electric lamps for lighting the streets, parks, and public p aces of the city of New York, for the period of one year, commencing on May 1, 1888, and ending on April 30, 1889. Address the Department of Public Works.

ARMORY.—Proposals are wanted at New York City, until March 20, for furnishing materials and performing the work in the erection of an armory building on the block bounded by the Boulevard, Ninth Avenue, Sixty-seventh and Sixty-seighth Streets. Address the Secretary of the Armory Board, Staats Zeitung Building, as above.

FIRE HOSE.—Proposals are wanted at New York Cito, until March 28, for furnishing 10,00 feet of 2½-inch balanced woven-cotton jacket rubber-lined hose with standard couplings attached. Address the Board of Commissioners, Fire Department, 157 and 159 East Sixty-seventh Street.

BUILDING.—Proposals are wanted at McPherson, Kan., until April 11, for the erection of the north wing of the county poor house, according to specifications, Address W. A. Morris, County Clerk.

BUILDING. -Proposals are wanted at Abilene Kan, until March 30, for the erection of a county high school building, for Dickinson County. Address W. H. Roe, Secretary, County High School Trustees, as

PLUMBING.—Proposals are wanted at New York City until March 27 or plumbing two water-closet towers at Bellevue Hospital. Address the Depart-ment of Charities and Correction, as above.

PAVING.—Proposals are wanted at Chattanooga, Tenn., until March 19 for paving certain streets with Trinidad asphalt street pavement. Addr sa Robert Hooke, Superintendent of Public Works.

FIRE HOSE.—Proposals are wanted at New York City, unti! March 28, for furnishing 20,000 feet of 23/4-inch circular woven-cotton, rubber-lined hose, with standard couplings attached. Address the Board of Commissioners, 157 and 159 East Sixty-seventh Street.

MASONRY.—Proposals are wanted at New York City, until March 20, for furnishing materials and performing masonry-work in the erection of an armory building on the block bounded by the Boulevard, Ninth Avenue, Sixty-seventh and Sixty-ei, hith Streets. Address the Secretary of the Armory Board, Staats Zeitung Building, as above.

Zeitung Building, as above.

SUBMARINE TELEGRAPH CABLES.— Proposals will be received, until 12 o'clock noon, the rôth day of April, for furnishing, delive.ing, and laying four nautical miles of submarine telegraph cable across the mouth of the Columbia River, Ore; a'so, until 22 o'clock noon, the 17th day of April, for furnishing, delivaring, and laying eight nautical miles of submarine telegraph cable for Martha's Vineyard, Mass For further information address A. W. Greely, Chief Signal Officer, Washington, D. C.

PILES, STONE, ETC.—Proposals will be received until 12 o'clock noon, March 31, for furnishing and delivering the following articles for use in improving the Mississippi River below St. Louis, Mo.: Piles, stone, manila and sisal rope, oakum, wire, noils, spikes, screw bolts, and iron. For further information address A. M. Miller, Major Corps of Engineers, St. Louis, Mo.

Louis, Mo.

IRUN-WORK.—Proposals are wanted at New York City, until March 29, for furnishing materials and performing iron-work in the erection of an armory building on the block bounded by the Boulevard, Ninth Avenue, Sixty-seventh and Sixty-eighth Streets. Address the Secretary of the Armory Board, Staats Zeitung Building, as above.

PLUMBING AND GAS-FITTING. — Proposals are wanted at New York City, until March 20, for furnishing materials and performing plumbing and gastiting work in the erection of an armory building on the block bounded by the Boulevard, Ninth Avenue, Sixty seventh and Sixty-eighth Streets. Address the Secretary of the Armory Board, Staats Zeitung Building, as above.

STEAM HEATING "AND VENTILATING.—
Proposals are was ted at New York City, until March
20, for furnishing materials and performing the steam
heating and ventilating work in the erection of an
armory building on the block bounded by the Boulevard, Ninth Avenue, Sixty-seventh and Sixty-eighth
Streets. Address the Secretary of the Armory Board,
Staats Zeitung Euilding, as above.

WATER WORKS,—Proposa's are wanted at Salisbury, Md., for a complete system of water works. No date specified. Address L. S. B-11.

PROPOSALS.

PUMPING ENGINE.—Proposals are wasted a Yonkers, N. Y., until March 20, for a 2,000,000 Extension, and boiler. Address Rudow Extensive, President Board of Water Commissione, above

BUILDING INTELLIGENCE

CHICAGO, ILL.—113 Cass, addn to brid stores; cost, \$10,000; o, Estate of S John. son; a, Cobb & Frost.

1935 Indiana av, br flats; cost, \$12,000; Hy I Willing; a, C Farwell; b, J Bor. 415-17 31st, br store and flats; cost, \$10.000; o, C Schmidt; a, J F & J P Doen; b, Geo Schneider.

587 Milwaukee av, br addn; cost, \$7,500;

o, Julius Pakowski; b, Julian Piska. Monroe, w of Clark, addn to hotel; cost, \$30,000; a, J L Silsbee.

West side, club house: o. Grant Club N w cor State and Washington sts, ig.

rovements and additions; cost, \$40,000;5. Stewart Estate. In Union Park, br, rubble and slate offer

bldg; cost, \$15,000; o, West Park Commissioners; a, Jenney & Otis. Dearborn av, nr State, "The Houghton" apartment house; cost, \$45,000; o, A J kg. ble; a, C P Thomas.

100 buildings costing less than \$7,000.

ST. LOUIS, MO.—Bell and Whittier ars. br dwell; cost, \$7,000; o and b, J. Ster-

Bloir and Cass avs, br dwell; cost, \$5,000 o, H H Vogt; b, Wm Kiersick

Broadway and Locust st, altering brid store: cost, \$30,000; o, Mermod Jacard (c; b, F C Bonsack

Olive st and Cabanne av, br dwell; cos. \$10,000; o, A A Eddy; b, T J Kelly

13th and Washington av, altering back hotel; cost, \$18,000; o, Sally C Famo; 2 L Kledus; b, sub let

Kossuth and Peck avs. 5 adi br dwds. st, \$10,000; o, Mrs C Brenggemans; h P Riechers

BOSTON, MASS.—Corner Scotia and Bothnia, br stable; cost, \$60,000; o, W D Vinal; a, D S Drisco; b, W D Vinal.

Dorr, near New Highland, woode stable; cost, \$10,000; o, Geo Curtis; 2, 6 A Avery; b, Wm Tobin. MILWAUKEE, WIS.—S w cor Ogden and

Jackson sts, 2-story double by store big 50x70; cost, \$7,000; o, C. Hamback; a F. Velguth; b, open.

Cor 11th and State sts, stone and by church; cost, \$200,000; o. St. Gaill's Church congregation; a, open; b. open.

N e cor Martin and Astor sts, alterations and improvements; cost, \$15,000; 0,] 6 Flint.

North Water st. br factory; cost, \$7,000; o, Chas Oldenberg Furniture Co.

Polk st, br bldg; cost, \$10,000; 0. Mirwaukee Gas Light Co.

Twenty-six buildings less than \$7,000. The plans for the new Jesuit Church onlik Marquette College grounds Milwauket have been rejected and new plans are being prepared.

GRAND RAPIDS, MICH.-S Division st. br block; cost, \$7,000; o, G K Nelson; b. J Postma

Cor Cherry and Union sts, br res; 008. contract for inside work not let

Cherry st, br res; cost, \$20,000; 0, Mr.A. Meigs; a, W G Robinson; contractor no known CHARLESTON, S.C.—A 4-story br bld;

cost. \$21,800;0, Charleston Co.; a, Abraha: & Seyle; b, P 1 Duffy

That amount does not include the heat ers, plumbing or furniture

PEORIA, ILL.—Board of Trade building cost, \$100,000; a, Burnham & Root, Chicago.

Br business block; cost, \$80,000; o, Sam Woolner; a, Burnham & Root.

TOPEKA, KAN.-The Central National Bank will erect a \$40,000 edifice here. W C Knox is to erect a new 5-story office



THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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A VIADUCT ROAD IN THE LATE SNOW-STORM.

THE only transportation line within a radius of at least 100 miles from the New York City Hall which did not succumb even for a few hours to the blizzard of March 12 and suspend the running of trains was the Suburban Rapid Transit Railroad. During the afternoon of Monday the headway of the trains was increased from six to about ten to fifteen minutes, but on Tuesday morning the traffic on this line was as frequent as usual, trains running at five and six minute intervals, when all other travel was completely blocked by the snow. The other elevated railroads soon recovered and resumed by degrees their regular trips, but the surface roads took several days to get into running order.

The Suburban Road had the advantage, to be sure, of having a route but little more than two miles long, but the true reason of its superiority was that it possesses a structure which is strong enough to bear the strain of locomotives powerful enough to overcome the obstacle of snow on the tracks. The other New York and Brooklyn elevated roads have not the strength of structure nor the efficiency of motive power to draw full trains against the resistance offered by the snow which drifted in between the timber guard-rails, and trains which had once started from the terminals could not be moved by the engines nor could they be lightened by dropping some of the cars, because there was no place in the streets to deposit the superfluous cars. Consequently, the absurd spectacle was pre-sented of miles of streets occupied by trains of crowded cars on elevated trestle held immovable by little gutters full of snow. But the 28-ton engines of the Suburban kept running regularly to and fro on its substantial viaduct, mostly on its own purchased right-ofway, the cars loaded with passengers, while half a mile away hundreds of people were snowbound in the cars of the Harlem and Hudson River Railroads in deep cuttings and in the sunken way through Harlem, and thousands were stored away in the elevated railroad cars in the avenues of the city, unable to get forward, backward or downward. While the character of the structure and of the rolling stock had much to do with this result, they would not have been so effective without the activity and energy displayed by Mr. E. B. Wetmore, the Superintendent of the Suburban Road, who was as untiring as he was judicious in his management of affairs under the trying conditions.

HE PROPOSED NATIONAL BUREAU OF HARBORS AND WATERWAYS.

THERE has been for some time more or less agitation by certain engineers in favor of placing civil engineers in charge of Government work connected with the improvement of rivers and harbors, and the idea has always been a popular one with many in the profession. When, therefore, the bill known as the Cullom-Breckinridge bill was introduced in Congress we published it and opened our columns for a discussion of its different clauses, with a view to drawing out opinions for and against the measure. We entertained views at the time regarding the practicability of it, but refrained from expressing them, as we desired to elicit the fullest discussion both from those in favor of the bill and from those who thought it would fail to accomplish the results anticipated. We have received a

large number of letters in response to invitations for an expression of opinion. The majority, however, were not written for publication. Many of the writers made suggestions, others expressed indifference, and others, while expressing sympathy with any movement intended to benefit the profession, claimed to be too busy to investigate the matter sufficiently to give an intelligent opinion.

We publish elsewhere two more letters on this subject, and, for the present, at least, think we have surrendered all the space to this subject that the general interest in it will justify. We must, therefore, refer those who wish to read the arguments of the authors of the measure to a publication, which is just issued by the Council of Engineering Societies on National Public Works at Chicago.

We have been urged by the promoters of this bill to discuss it editorially and to express our "candid views" on the subject.

Briefly, then, the practical question, as it appears to us to-day, is, "Will the cause of river and harbor improvement in the United States be benefited if the change contemplated in this bill is made at this time, in view of the changeable character of Congress and the effect of political influences?" The establishment of a bureau employing about six hundred engineers, requiring something like a million and a quarter of dollars annually for salaries, may be a pleasant prospect for engineers who want positions, but we very much fear that ultimately every member of that corps would be taxed to maintain a lobby in Washington to secure the annual appropriation for their salaries, besides appropriations for work to keep them employed, and experience would lead to the belief that the result of all this would be that the control of the bureau would drift into the hands of wire-pullers and politicians. The opponents of river and harbor improvements would, moreover, receive a strong re-enforcement in the way of arguments against the propriety of appropriations for internal improvements, since they would be able to point to the existence of such a lobby, and urge that the recommendations of the engineers were influenced by their desire to secure work in order to retain their positions. Such a charge cannot now be made against the recommendations of the army engineers, because it is universally known that their pay is in no way contingent on the passage of a river and harbor appropriation bill, they being paid as army officers whether assigned to engineering work or not. It is for this reason that their recommendations have had more weight with Congressional committees than would the opinions of the same number of men in civil life in all respects their equals.

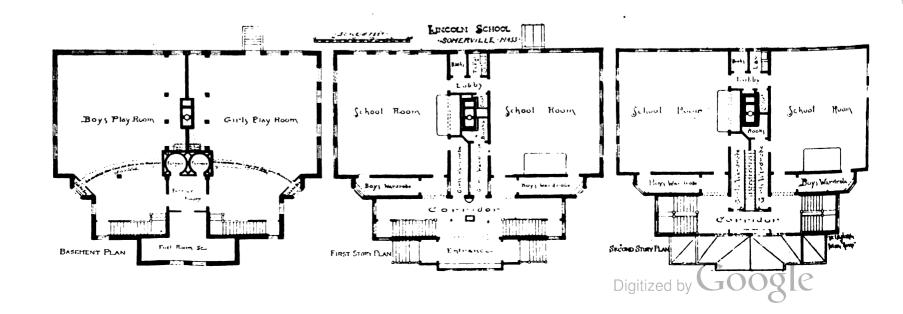
There are two features of this problem that have always appealed strongly to us: First, the question of intermittent appropriations by Congress, which method results in so much injurious delay and ultimate unnecessary expense in the execution of work; and second, the fact that faithful and capable civil engineers employed on Government work have no chance for promotion to independent charge of work and consequently little opportunity for making professional reputation.

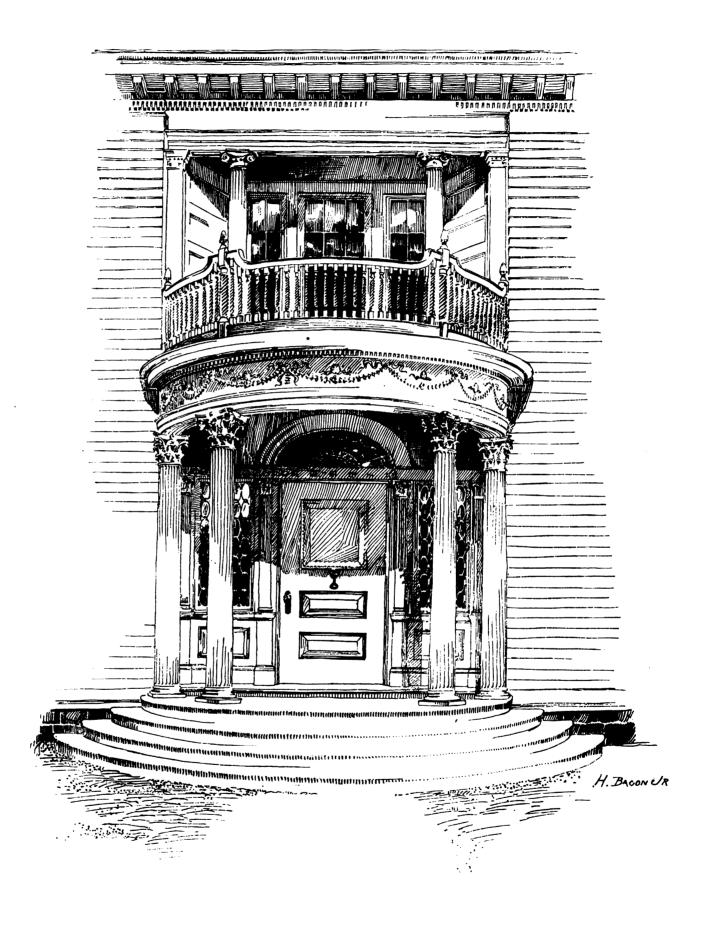
Section 14 of the Cullom bill seeks to deal with this evil of intermittent appropriations, but we fail to see how one Congress can control a subsequent one. Appropriation bills in this

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THE LINCOLN SCHOOL, SOMERVILLE, MASS.—GEORGE F. LORING, ARCHITECT, BOSTON.





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

PORCH OF RESIDENCE OF MR. THORPE, CAMBRIDGE, MASS.

LONGFELLOW & HARLOW, ARCHITECTS.

country are passed or withheld too often from considerations of political expediency—i. e., a Republican legislative body is not apt to appropriate money, if it can avoid it, that a Democratic administration will have the spending of —and this would be especially true when money was to be spent by a civil bureau. Consequently, for a time, at least, appropriations for public work in this country are not likely to be made in

any but an intermittent manner.

With regard to the status of civil engineers now employed in subordinate positions on Government work, there is an act of Congress that has authorized the appointment of several civil engineers of high grade to independent charge of work. It would seem to us practicable even at this time to arrange for the appointment of an additional number of those higher grade officers, to be taken entirely from those who are or may be in Government employ as civil engineers, pay to correspond with similar grades in the army, and vacancies as they occur to be filled from the civil engineers employed on Government work, all to be under the Chief of Engineers and attached to the present organization.

This would give the opportunity for promotion, now withheld, and independent reputation which every professional man so much prizes. A provision somewhat on the lines here indicated it carried out would remove to a large extent from the minds of civil engineers generally what they regard as a real grievance and would offer inducements to men of capacity to remain in the civil corps of the service.

We believe when the influential men in Congress are consulted on this question the friends of this measure will learn that the Government considers it to its interest at this time to avail itself of the services of the army engineers. As the country becomes older, the public more enlightened, and legislative bodies more rational, the example of older countries in providing a special department for the execution of public works may be followed with better results than it would be possible to secure under existing conditions.

THE CAR-STOVE AGAIN.

DURING the recent storm, when the New York Central trains, like those on every other line running out of New York, were stuck for several days in snow banks and locomotives were detached, the steam heat from the locomotives of course could not be relied upon for car-heating. President Depew is reported to have stated that that circumstance demonstrated that in this country we would have to rely upon the car-stove for car heating. That remark being quoted seems to have met with the very genera protest that it deserves. It is entirely practicable for railroad companies to provide in each car a stove to be used only when a train is disabled and steam from the locomotive cannot be obtained.

It is worthy of remark in this connection that George Gould, who was on the wrecked Florida train last week, in the interviews reported, stated that as soon as he extricated himself and wife from the debris and saw the mass of crushed and mangled people in the destroyed cars, his first thought was that the train would catch fire and many of them be burned. The passenger cars which were at the head of the train, doubtless in that climate contained no fires, and, from the reports, we believe steps were taken to immediately put out the fires in the Pullman sleepers.

George Gould will some day probably be the owner, as his father is now, of many miles of railway. It is to be hoped he will always remember that experience when he has to consider the methods of heating railway trains on the roads that he has the control of.

A BILL has been introduced into the House of Commons under the title of the Architects', Engineers', and Surveyors' Registration Bill, and purporting to be the petition of the Members of the Royal Institute of British Architects, and drafted by the "Architects', Engineers', and Surveyors' Registration Act Committee." The fact that the Royal Institute of British Architects is not connected with the movement, and has moreover issued a notice by its secretaries to its members asking them not to sign any forms in connection with the movement, does not augur well for the success of its second reading.

CANALS AND INLAND NAVIGATION.

IT is the intention of the Society of Arts of London to hold a conference in May next on the subject of canals and inland navigation. In the year 1885 an international conference on this subject was held at Brussels, and in the following year there was one at Vienna. The third meeting is to be this year at Frankfort. It is not, however, proposed that the Society of Arts Conference should be of an international character, as naturally the canals of this country are not in any way dependent on, or connected with, those of other countries. Amongst the subjects set down for discussion are included the history of canals in Great Britain, the engineering of canals, the present condition of canal navigation, with suggestions for its improvement, the connection between canals and railways, tariffs, cost of carriage, etc. It is also proposed to include in the proceedings some account of the canal systems of foreign countries, and the committee have already been promised several papers on this head. Further information as to details of the arrangements may be obtained from the Secretary of the Society of Arts.

ANOTHER CHANNEL BRIDGE PROJECT.

FRENCH engineers are said to be projecting plans and estimates for a bridge between France and England with termini at Cran-aux-Oeufs, south of Cape Grisnez, and at Solkestone, thus crossing not at the narrowest, but at the shallowest part of the channel. The piers are to be of beton, and the superstructure, at an elevation of 40m. (131.24 feet), of iron from the Creusot Works, whose engineers are said to be the designers.

Admiral Cloué, late Minister of Marne, and M. Heredia, Minister of Public Works, are said to support the scheme and to be seeking English assistance for it.

FIRE-PROOF THEATRE DECORATIONS.

THE many different processes in use for rendering curtains, etc., incombustible are said to be, without exception, unsatisfactory and imperfect, the fire-proofing material with which they are saturated either disappearing or losing its efficacy after a time.

The Chronique Industrielle states that M. E. Tepper, of Berlin, has invented a process by which it is possible to paint decorations on an absolutely incombustible iron wire cloth, the meshes of which are about 0.04 inches square. It is covered by a mechanical process with a yellow plaster that is incombustible and insoluble in water.

This coating is very liquid when applied, but afterward takes the consistency of firm clay. It receives paint readily and can be rolled upon poles about two inches in diameter without injury. The weight of the prepared material is less than a pound and a half per square yard, and the price does not exceed that of decorations made incombustible by impregnation.

PULMONARY EXHALATIONS.

MM. BROWN SEQUARD and d'Arsonval have been examining the air expired by men and animals, and find by analysis that there is always present: First, an insignificant quantity of ammonia; second, very small quantity of organic matter, which, if not already putrefied in the pulmonary passages, has a strong tendency to decay rapidly even at a low temperature; third, if confined it is also harmful on account of the carbonic acid which it contains to the dangerous amount of more than I per cent.

The Chronique Industrielle says that experiments made n rabbits to determine the effect of aqueous injections charged with the poisonous principle, produced by the pulmonary mucous, showed that the human lungs, as well as those of dogs and rabbits, in a healthy condition, produce a very energetic poison that is continually diffused by the exhaled air, and that it is extremely probable, if not certain, that it is this poisonous agent that renders confined air so dangerous to animal life.

According to experiments mentioned in Indian Engineering the tensile strength of a wet rope is only one third that of the sam; rope when dry, and a rope saturated with grease or soap is weaker still, as the lubricant permits the fibres to slip with greater facility. Hemp rope contracts strongly on being wet, and a dry rope twenty-five feet long will shorten to twenty-four feet on being wet.

CINCINNATI WATER-SUPPLY.

THE Board of Expert Engineers employed by the city Cincinnati have completed their investigations, and or Chemnat have completed their investigations, and made a preliminary report in shape of replies to the several propositions submitted for the new system of water-supply. The board consisted of Henry Flad, of St. Louis; Charles Hermancy, Louisvil'e; Alphonse Fteley, New York; Charles B. Brush, Hoboken, N. J., and Dewitt C. Cregier, Chicago.

"The questions and our answers thereto may be briefly

stated as follows

No. 1. Is the location of the present intake on the Ohio River a proper one? Answer. No.
"No 2. Is it practicable and advisable to enlarge and

improve the present pumping-station? Answer. It is not.

No. 3. Is it practicable and desirable to supply Cincinnati with wholesome water from a system of driven

wells? Answer. No.

''No. 4. What source of supply do you recommend?

Answer. The water should be taken from the Ohio River above the Little Miami River, and from an inlet tower or

pier placed on the northern or right bank of the river.

"No. 5. What location do you recommend for the pumping-station? Answer. This question cannot be fully answered until further examinations and surveys have been made. We recommend that a competent engineer should be selected at once to proceed with this work. The necessity for such action will become apparent to you when we state, as we do, that, in our opinion, the plan of constructing a storage reservoir on the Markley farm is impracticable for reasons which will hereafter be fully given.

"No. 6. What method of clarifoction if any description is a superscription."

"No. 6. What method of clarification, if any, do you recommend? Answer: No definite plan can be recommended at present, but we believe it advisable that the engineer selected for making the surveys and examinations above referred to should also be intrusted with the duty of instituting a series of experiments on the applicability of the different methods now in use for clarifying the water by settling and filtering, and that this should be done on a scale sufficiently large to admit of its serving as a guide a scale sufficiently large to admit of its serving as a guide in arriving at an intelligent conclusion, both as to the practicability and cost of the process. We may, in our full report, definitely indicate the nature and extent of the experiments which we consider necessary.

"Besides the questions answered above several others have been submitted verbally by members of your Com-

have been submitted verbally by members of your Com-

mission. To these questions we reply as follows:
"It would be unsafe to rely on a single line of supplymain under any circumstances. The supply-main should be of cast iron. We consider the use of a supply-main of cast iron sixty-two inches in diameter as not warranted by practical experience. The main supply-pipes, where laid in embankment, should be placed at a safe distance apart. We beg leave to call your attention to the fact that surveys may be made, within a month or two, sufficient, if properly directed, to determine the general system to be adopted; and that, therefore, the construction of new works will not be materially delayed. Early relief may in this way be received by the city if the necessary means for

rnis way be received by the city if the necessary means for prosecuting the work are promptly obtained.

"There are several feasible methods of utilizing the water taken from the intake, located, as above proposed, beyond the mouth of the Little Miami River, for supply-

ing the city.

The one that is most practicable can be easily determined as soon as the surveys have been made and the

plans prepared.

"It is not practicable to obtain from the Dayton bar a permanent supply of water for Cincinnati.

"In conclusion we deem it pertinent to say that from every point of view we cannot too strongly urge prompt action in the pressing and very important matter of an increased and improved water-supply for the city of Cincinnation.

nati.
"While, for the reasons above stated, we are not prepared to submit an estimate, we are inclined to believe that the cost of any system of supply which we may be prepared to recommend will not exceed \$6,000,000."

OUR ARCHITECTURAL ILLUSTRATIONS. PORCH OF RESIDENCE OF MR. THORPE, CAMBRIDGE, MASS.-LONGFELLOW & HARLOW, BOSTON, ARCHITECTS.

THE LINCOLN SCHOOL, SOMERVILLE, MASS. -GEORGE F. LORING, BOSTON ARCHITECT.

THIS school building, situated at Somerville, Mass. is wooden frame, brick underpinning, hard pine floor-joists, and slate roof. It is finished in pine, natural, in-side blinds with pockets, maple floors, concreted play-rooms. The ventilation is by means of galvanized-iron ducts to brick shaft in centre; the vent spaces are large enough to admit a man through iron doors in basement; all heating is by register eight feet from floor, and ventilation by two registers in each room, one near floor, another eight feet from floor; all heating and ventilating ducts are eight feet from floor; all heating and ventilating ducts are in inside walls and the results are very satisfactory by using top vent in summer and bottom vent in winter. The heating is by hot air, two furnaces, one for first floor and one for second floor, run separately or with common heating chamber. In summer time the ventilating shaft is heated by gas jets.

The cost was \$12,000. The architect was George F.

Loring, of Boston.



CEMENT MORTARS FOR USE IN PUBLIC WORK.*

THE primary duty required of mortar, whatever may be THE primary duty required of mortar, whatever may be its quality, is to connect or unite the bricks or stones used in the structure, and to adhere closely to the surfaces of the individual blocks or fragments, thus binding or cementing them together into a single coherent mass, just as separate pieces of wood are joined or united by the aid of glue. The quantity used need be only large enough to thoroughly coat every piece of stone or brick, and to completely fill out all of the intersties between them. It is a common practice among masons in this city and elsewhere to fill the larger interstices, which always occur in the rear to fill the larger interstices, which always occur in the rear of the face stones of a wall, with small fragments of stones laid in dry and promiscuously, and then to smear some mortar over the top of the mass, in order to hide the improper workmanship. This practice is exceedingly reprehensible. Every intelligent and skillful workman knows that to produce sound and durable masonry, mortar should first be deposited freely in these spaces and the fragments of stone imbedded therein, after which the process may be repeated until each space is full. In many cases concrete

repeated until each space is full. In many cases concrete is used by engineers for this purpose, and rammed into place, in order to prevent the carelessness just described. In modern practice, for rubble or other masonry, where strength is of more consequence than appearance, full beds and joints are generally considered to be better than thin ones. In such work from one-third to one-fifth of the entire volume of the masonry is occupied by mortar, depending upon the manner in which the stones are dressed and laid, and also upon the skill of the mechanic. Greater skill is needed to properly build a rough or uncoursed and laid, and also upon the skill of the mechanic. Greater skill is needed to properly build a rough or uncoursed rubble wall than one wherein the stones have been nicely dressed; but, on the other hand, a greater strength is required for the binding material, or mortar, since the beneficial effect of the interlocking of the stones and the distribution of strains by large blocks at regular intervals is greatly diminished in rubble masonry constructed with small stones. In such cases the quality of the mortar and the workmanship become of the utmost importance.

Obviously, if the stones are small and irregular, the

masonry must be regarded only as a mass of concrete, in which each fragment of stone is to be cemented or joined more or less firmly to the adjacent fragments by means of the mortar; and in such cases something more than mere hardness after the lapse of a certain time will be demanded of the mortar or binding material. Its capacity for adhering to the surfaces of the stones or brick, as well as its cohesion, are then brought into consideration, in order to prevent any displacement of small blocks or fragments of stone, etc., distributed more or less densely throughout the mass. On the other hand, if the blocks of stone are relatively large and regular in form, the mortar under such conditions is subjected essentially to compression alone, and its properties of hardening, or indurating, need only be taken into account

In many kinds of public works, however, such as the side walls of large sewers, bridge abutments, retaining walls, etc., likewise the concrete foundation for asphalt pavements which are quickly opened to traffic, the stresses to which the masonry is subjected within a comparatively short time after completion are not only simple pressures, as above described, but lateral or oblique forces of more or less intensity, also act upon the mass, and tend to destroy it by causing the slipping of one stone or course over the the next one below, the overturning of a portion, or the displacement of any component part of the structure in general. It is manifest, therefore, that in work of such character the mortar must necessarily be of a better quality than where it is called upon to resist simple pressure alone and the measure of the strength, durability, and safety of the structure becomes in fact the measure of the strength of the mortar in binding together the individual pieces into a coherent mass.

Theoretically, the best wall or masonry structure is one Theoretically, the best wall or masonry structure is one in which the cementing material is just as strong as the brick or stone joined together. It, therefore, becomes necessary to know something of the actual strength of the mortar, both with respect to cohesion and adhesion, during the first few days after its preparation and use in the structure, in which period it may be subjected to severe lateral stresses, and sometimes even to much greater stresses than will probably be brought to bear upon the masonry at any subsequent time. Little bear upon the masonry at any subsequent time. Little attention seems to have been given to this subject by experimenters and authors, since it is tacitly assumed on all sides that no improper strains shall be allowed to act upon the fresh masonry. This important assumption cannot, however, always be realized in municipal work, since the public convenience frequently demands the completion and straining of a masonry structure much earlier than the dimensions or quality of workmanship adopted would seem to warrant; and when, in such an event, the structure is not seriously injured or deformed, the circumstances may generally be regarded as a happy accident, rather than as the outcome of wise forethought on the part of either designer or builder. To assist somewhat in arriving at a fair measure of the strength of hydraulic mortars at different periods of time, as well as the proper composition of the same, the statistics given in tables Nos. 2 and 3, hereunto appended, have been compiled from a great variety of sources, and attention thereto is herewith invited. The record of mortar tests made with American to warrant; and when, in such an event, the structure is The record of mortar tests made with American natural cements is not very extensive, and particularly is this the case with reference to tests for adhesion to the

TABLE No. 2.—ADHESIVE STRENGTH OF CEMENTS AND MORTARS.

		Average adhesive strength in pounds per square inch.								
AGE WHEN	KIND OF CEMENT	MATERIALS CEMENTED		 	1 ::	l #	I # .	1 ::	1 :-	
TESTED.	USED.	Тосктнев.	= =	نا ي	7. 6		.; →	3. 1	ۍ ر	AUTHORITY.
I ESTED.	C3ab.	TOGETHER.	عَ قِياً		5.5	5 2	1 E 2	5.5	5 g	
	,		Neat Cement.	Cement, Sand,	Cement Sand,	Cement,	Cement, Sand, 4.	Cement Sand.	Cement Sand,	
					1		<u> </u>	-		
One week	Quick-setting coment	Hard, dense brick			*23		! . · · · · · ·		ļ	Mr. Robertson
	Portland	Sawed limestone	57		715		ļ . .		j	I J. Mann
	l **	Cut granite	4.7							J. Mann
		Polished marble	38					 .		**
		Bridgewater brick	to		· • • • • • • • • • • • • • • • • • • •		'			
	Hydraunc nme	¶ Br ck \$ Br ck-work	24.1	21.0	18.7	15.3	13.2			Pr. Böhme
	1	‡ ".		102	38	20	16	• • • •		Prof. Warren
ixteen days.	Onicklime	Limestone			53					Boistard
•	Lime and cement	¶ Brick		١	5					**
8 days	Hydraulic lime	Brick	35.1		25.5	23.9	17.5			Dr. Böhme
	Portland	\$ Brick-work		105	45	24	14			Prof. Warren
ne month	Quick-setting cement	Hard, dense brick		146	73	48			l	
	Slow-setting cement				T59		•••••			Mr. Robertson
	Kosendale	Croton, N. Y., brick	30.8	15.7	12.3	6.8	5.2			Gen. Gilmore
	_ :	Fine cut granite	27.5	20.8	12.0	9.2	7.9			••
	Portland	awed limestone								I. J. Mann
		Polished marble								
	44	Reidgewater brick	1 1/2							
	Blue has hme	Stattordshire brick			*40					"Building News"
		Gray stock "			*36	.:: ::				•
	Lime and Puzzolana	Hard brick			_				· · • • · ·	
2 davs	Portiand	1 + + Brick	68 8		.6.					J. White Prof. Bauschinger.
days	** **** ********	TT "	1			24.2	•••••	••••		to
6 days	., .	++ **		54.0	56.9					
days	Hydraulic lime	1	39.3	41.9	38.9	28.1	22.6			Dr. Bohme
odavs	Hydraulic lime	++ ** ¶ ** ++ ** Hrick.		• • • • • • • •		14.2	,			Prof. Bauschinger
x months	Oucklime	Brick			****	12.8				Rondelet
										Kondelet
										Mr. Robertson
	Dartland	Soft, porous brick			*18					
					••••	• • • • • •				I. J. Mann
					· · · · · · ·		• • • • • • •	'		
ine months.					*8			• • • • • •	• • • •	[. White
ondave i	Kosepriale	Croton N V brick		1		!		1		Gen, Gilmore
ne year	Good anicktime	Not stated				*21				Vicat
ļ	Ordinary hydr lime	4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	•••		··•;	*51		•••••	• • • • •	**
ļ		66 66		• • • • • •	*85		• • • • •	• • • • • • • • • • • • • • • • • • • •	•••••	••
1				70	140					Mallet
		water		00		!	i			**
i		Gauit-clay bricks, pressed	45	44						J. Grant
Î	**	Stock bricks, in air	, , ,	63						•• •• •••••
	**	Staf. blue bricks, in air	9-							
	**	" " in water	48 40							
		Fareham red bricks, in air in water.	126	83						
1	**	" 'in water	123							

Notes. * Exact proportion of sand not given, but presumably about those indicated in headings of Table.

+ Coarse particles in cement sifted out before testing.

\$ Clean river sand used in mixture.

\$ Crusned sandstone used in mixture.

* The sand used in mixture in mixture in mixture.

* Fine river sand used in mixture.

¶ Standard sand used in mixture. # Fine river sand used in mixture.

TABLE No. 3.-SHEARING STRENGTH OF CEMENTS AND MORTARS.

				Avera			Strengt ire inch		pounds			
	AGE WHEN	KIND OF CEMENT.	Астнокіту.	Neat Cement.	Cement, 1; Sand, 1.	Cement, 1; Sand, 2.	Cement, 1; Sand, 3.	Cement, r; Sand, 4.	Cement, 1; Sand, 5.	Сна	CHARACTER OF S	
	I. Shea	ar in, and parallel to, bed jo	ints of Brick-work.									
42 40 52 90 90	" "	Portland (Bonn) " " " (Perlmoos) Hydr. lime " " Quick " "		73.9	155.0	106.6	64.0 72.7 76.8	•• ••		**		
	II. Shea	r in Cubes of Cements and	Mortars dried in air.									
60 1 2	daysweekweeks.			. 256.0 224.7 301.5 270.2 322.8 257.4 341.3	405.3	383.9	362.6 108 1 123.7 128.0 163.5 153 6 199.1 196.2	320.0	66.8 78.2 93.9 122.3 112.3	Coarse Clean,	Medium	

Note.—*Average values for series of four different brands of quick-setting cements.

†Average values for series of four different brands of slow-setting cements.

various kinds of stone used for building. Tests of mortar made with Portland cement and other cements have, therefore, been included both in order to submit the subject in a more complete manner, and to point out the fact that more attention to the composition of the cement mor-tars used in public work in this city may profitably be be-

Strange and anomalous as it may seem, most of the cement tests made in this country and England are carried out for the purpose of ascertaining the tensile strength of neat or pure cements, although such material is rarely, if ever, used in masonry without the admixture of some sand. In Europe, on the other hand, the practice was established about ten years, both by manufacturers and engineers, to determine the value of a cement by testing it when mixed with sand into mortar, the usual proportions of the mixture being three volumes of sand to one volume of cement. It is obvious that the latter practice is preferable since thereby a knowledge of the strength and properties of the

binding material actually used in the work will be gained, and furthermore, because no valid inference as to the co-hesion of a mortar can be drawn from a statement of the tensile strength of the neat cement. Tests of this kind should, therefore, be made with cement mortar, mixed in the same proportions as contemplated in the work itself, and also with the same sand if practicable, inasmuch as the quality of the latter exerts a marked influence upon the resulting strength of the mortar. In general it may be said that the greater the proportion of sand in the mortar tested the more accurately can the actual cementing quality the cement be indicated.

The secret of good masonry lies in having the mortar strong or thick and the bricks or stones wetted.

In regard to the proper amount of water to be used in tempering a cement mortar, it may be said that this will depend upon the quality and quantity of the sand, as also From the numerous and upon the quality of the cement. From the numerous and careful experiments with Portland and Rosendale cements.



^{*}Abstract of a report by the Executive Board of the City of Rochester, N. V., prepared by Emil Kuichling, M. Am. Soc. C. E.

made a few years ago by Mr. Eliot C. Clarke, C. E., and made a tew years ago by Mr. Enot C. Clarke, C. E., and published in the Transactions of the American Society of Civil Engineers for April, 1885, the inference was drawn company to the American cements required. Civil Engineers for April, 1885, the inference was drawn that "as a rule, American cements require more water than Portland, fine ground more than coarse, and quick-setting more than slow-setting cements." For experimental setting more than slow-setting cements." For experimental purposes in the laboratory, the amount of water added by Mr. Clarke to the dry mixture of sand and cement was usually about one-fourth the weight of the Portland, and one-third of the weight of the American cement contained in the batch: but these amounts were increased or discipline one-third of the work in the batch; but these amounts were increased or diminin the batch; but these amounts were increased or diminished somewhat in order to obtain mortars of uniform consistency. Mr. Clarke adds, that in mixing mortars on the sistency. Mr. Clarke adds, that in mixing mortars on the sistency of public works, and particularly for concrete works, site of public works, and particularly for concrete works, much larger quantities of water than are used by him for testing purposes are commonly added by workmen in order to render the labor of mixing and spreading less difficult, but that the result of this procedure is always a more of to render the labor of mixing and spreading less difficult, but that the result of this procedure is always a more or less great loss of strength. For the standard tests of cement mortars by European engineers the rules prescribe one part by weight of cement, three parts by weight of normal sand and four-tenths of a part by weight of clean, test water.

Portland cement acquires its strength more quickly than Rosendale. Both cements, but especially the Rosenthan Kosendare. Both cements, but especially the Kosendale, harden more and more slowly as the proportion of sand mixed with them increases; and whereas neat sand mixed with them increases; and whereas neat cement and rich mortars attain nearly their ultimate strength in six months, or less, weak mortars continue to harden for a year or more." It has also been found that after a period of about a year, weak mortars often lose in strength or tenacity what they may gain in hardness, from the fact of their becoming more brittle. Specimens from the fact of their becoming more brittle. Specimens of such mortar two years or more old break very irregularly. Mortars less than one month old are relatively weak, and hence the advantage of waiting as long as possible before loading masonry structures. Portland cement mortars are especially useful in cases where the masonry is necessarily subjected to severe strains within so short a period as one week. Specimens

period as one week.

The standard of tensile strength required by German engineers of Portland cement mortar, prepared by mixing one unit of weight of cement with three like units of norone unit of weight of cement with three like units of normal sand, and four-tenths of such a unit of clean, fresh water, and tested after an exposure of one day in air, and twenty-seven days in water, was formerly 114 pounds per square inch. A few years ago the standard for a slow-setting cement was raised to 142 pounds, and at the present time it has been further raised to 227 pounds. For quick-setting Portland cements somewhat inferior strengths than the latter are expected after the same period of time. In the construction of the French harbor works at Calais and Boulogne, Mr. F. Guillain, C.E., in a recent report on the tests of the Portland cement used there states that the minimum tensile strengths specithere states that the minimum tensile strengths specified for tests with neat cement were as follows: 282

pounds per square inch after seven days, 498 pounds after twenty-eight days, and 640 pounds after eighty-four days. According to eminent English authorities, Portland cement, tested neat, should give a tensile strength of at least 200 pounds per square inch after seven days' immersion in water; and when tested with an admixture of three parts of sand to one of cement, its strength should be about parts of sand to one of cement its strength should be about 112 pounds per square inch after one day in air and twenty-seven in water. For use in public work where other than compressive strains act upon the structure, it should not be mixed with sand in smaller proportions than one part of cement to three of sand. Natural or "Roman" ements, when tested neat, usually exhibit tensile strength after seven days in water. Such cements should not have a greater admixture of sand than in the proportion of one to one, in all structures subjected early to the action of the structure of the subjected that is the subj lateral forces. They also develop their greatest strength when freshly burnt and finely ground.

RAPID RAILWAY EMBANKMENT CONSTRUCTION.*

THE object of this paper is not to give you information upon new engineering topics, but to describe the methods adopted in performing a certain given amount of work in a brief period of time. The difficulties that have been overcome in the work about to be described were more from a shortness of time than from any other cause. The a brief period of time. The difficulties that have been overcome in the work about to be described were more from a shortness of time than from any other cause. The work is located in the city of St. Louis, namely, on Hall Street, between North Market and Bremen Avenue. A franchise was granted to a certain railway corporation in this city to build its railway tracks over and upon certain portions of various streets and wharves in the city of St. Louis, which, among other things, required that the railroad company should "fill Hall Street forty feet wide to the established grade within one year" from the date of the approval or the ordinance granting the franchise. Certain difficulties were in the way, and were not removed until all the time mentioned in the ordinance had expired excepting twenty days. The amount of work required to be done to comply with the terms of the ordinance and save its being forfeited—namely, that of filling IIall Street forty feet wide to the established grade from North Market Street to Bremen Avenue, involved the building of an embankment about a mile and a quarter in length, requiring about 97,500 cubic yards of material. All of this material had to be obtained from points outside of the limits of the streets, it being an embankment the whole distance.

A ad by Isaac A. Smith before the Engineers' Club of St. Louis, and published in the Journal of the Association of Engineering

^aR ad by Isaac A. Smith before the Engineers' Club of St. Lou's, and published in the Journal of the Association of Engineering Societies.

Two borrowing pits were secured near the centre of the work, with an average haul from the borrowing pits to work, with an average half from the borrowing pits to the place of deposit in the road of about 1,300 feet. These borrowing pits were composed wholly of silt, and situated upon the west bank of the Mississippi River. The first work performed was that of building a road from the borrowing pits to the embankment. This was done by cut-ting down the willows which grew over the borrowing pit, and between it and the street upon which the embankment was to be constructed, and laying them crosswise of the road and putting dirt upon them to hold them down, the road of course being simply a temporary one for use dur-ing the time of construction. After clearing all of the logs, stumps and other debris from the surface of the pits, which required two days, on the morning of the third day the work of constructing the embankment began. horse wagons were placed in service for each pit, one hundred and twenty in all. opened in each pit of sufficient width to load twenty wagons at one time, and seven men were detailed for each wagon, making 140 men, exclusive of a foreman in each pit. After the wagons were loaded they were driven straight forward, without turning, to another road already constructed, and, following this road, conveyed their load to the place of deposit. When the wagon reached the place of deposit, or dump, as we call it, it was driven on the dump to a place designated by the dumpman. If by any accident or fault of the driver or horses the load was stopped short of the point designated it was at once unloaded, for the orders were strict against per-mitting teams to pull a second time on a load after it was stopped on the soft dump. The wagon, after being unloaded, proceeded over the forward end of the dump to the road in the pit. A ticket-boy, provided with a sufficient number of tickets, all alike, handed one to the driver of the wagon as he passed going to the pit. Drivers were required to exhibit forty of those tickets for a day's work. The tickets were returned to the time-keeper every even-Each wagon was numbered, and each shoveler and dumper was numbered. Men and teams were known only by their numbers. Their numbers appeared upon the time-book instead of their names. The object in doing this was to prevent a multiplication of similar names. which is often a source of serious error in keeping time on large works. There was one walking foreman in each on large works. pit, whose business it was to preserve order among the men and direct where the wagons were to be loaded. The men were not allowed to speak to each other, neither were they allowed to smoke or drink. Teamsters were not allowed to leave their seat upon the wagon. Men were employed, who carried water and watered the horses when they needed it. Ice water was carried to the men when it was needed. If a man was derelict in his duties, or was falling behind in the performance of what was expected of him, the foreman would warn him first that he must do better. If a second warning was necessary it came in the shape of a discharge, the foreman being provided with a pad of blank discharges requiring a very small amount of writing, one of which he made out and handed to the dissmall amount of charged employee, who conveyed it to the time-keeper, and from the time keeper he received a check on the treasurer for his money, his number being preserved after he was discharged, and a remark made opposite the number in the time-keeper's book stating the cause of his discharge. If the cause was not through any fault of his own, if it was from sickness of himself or family, or from any cause that he could not control, there was no objection to his being re-employed; but if his discharge was occasioned by laziness, desire to drink, or any fault of his own, he was not re-employed. Each pit foreman was provided with a staff eight feet long. Three feet and three inches from the end of this staff was a notch cut in it. There was also a notch cut twenty inches from the end. The length of the staff indicated the required length of the wagons. The first notch mentioned—namely, the one three feet and three inches from the end, was the required width of the wagons, and the twenty-inch notch was the required to enter the pits that did not comply exactly with these dimensions. The wages paid to teamsters was \$4 per day; to walking foremen, \$2.50 per day; time-keeper, \$2.50 per day; dumpmen and shovelers, \$1.50 per day; ticket boys, \$1

The second pit was operated precisely as has been described for the first one. The embankment had been properly staked out by the engineers, slope stakes with the fills marked upon them at frequent intervals, and skilled dumpmen were secured where it was possible to do so. The work from these two pits proceeded in this manner until the 97,500 cubic yards of material had been deposited in the embankment. However, all of the material required for the embankment did not come from these pits. There were some cellars being dug in the vicinity and some street reconstruction; from both of these sources some material was obtained, it being hauled to the dump by the conwas obtained, it being hauled to the dump by the contractors for these respective works. A separate system was observed for this character of work. The teamsters were each given a ticket for a load. The tickets were printed and were numbered serially, and each of them contained the autograph signature of the chief engineer. This was done to prevent counterfeiting. These tickets were redeemed at the office of the company in quantities exceeding ten, and ten cents apiece was paid for them generally. The wagons which conveved this outside material to dump were of different sizes. Some of them would contain more were of different sizes. Some of them would contain more than a yard and some less. In sixteen days from the time the work began it was finished forty teet wide to the estab-lished grade; that is to say, within a period of sixteen

days 97,500 cubic yards of material was deposited in Hall Street between North Market and Bremen Avenue embankment was about ten feet high and forty feet wide on top. It is usually the case that where work of this character has to be *rushed*, or done within a given period of time, that little or no attention is given to the cost of the work, but in this instance the cost was a very important matter, and every point was closely watched so as to secure a minimum price per cubic yard for this embankment. Before the company concluded to do the work itself a number of prominent contractors were requested, after visiting the premises, to make bids for doing the work, accompanied, of course, by a guarantee that it would be done within the time required—namely, twenty days. No contractor would give that kind of guarantee, and the lowest price to be obtained from any of the contractors for this work, without a guarantee, was 35 cents per cubic yard. The actual cost of doing the work in the manner described was eighteen and fifty-eight hundredths cents per cubic yard, which was but little more than one-half of what it would have cost had it been let to the lowest bidder for The weather, during the time the work continued, was very mild and pleasant, conducive to the largest results in a given period. The character of the material conveyed from the borrowing pits to the embankment was such that it required no picking or plowing, but could be readily shoveled, being silt deposit from the river. Care was taken in the pits to see that the surface of the ground was taken off evenly, consequently loaded wagons very rarely "stalled" in the pit, or got in each other's way. However, an extra team was kept in each pit to help loaded wagons if there was any tendency to stall on help loaded wagons if there was any tendency to stall on the part of the horses attached to the loaded wagon. Not more than one pair of horses was required, however, to over twenty teams. The utmost harmony prevailed among the men; no talking was permitted, as I have before remarked, and at noon hour the men were required to take their lunch as near as possible to the scene of their operation. Work began at half past six in the morning, ended at half past five in the evening, and one hour for feeding at noon, which left ten working hours.

ing hours.

Several eminent local engineers, knowing the extent of the work, gave it as their opinion that it could not be done in the limited time, and the writer confesses that he was of the same mind; but there was no alternative but to try; and favored with fine weather, excellent materials, and thorough organization, the task was accomplished within the allotted time.

PROPOSED NATIONAL BUREAU OF HARBORS AND WATERWAYS.

> DEPARTMENT OF ENGINEERING. COLLEGE OF NEW JERSEY, PRINCETON, N. J., March 7, 1888.

SIR: Whatever may be said of the details of the Cullom bill, its general purpose seems to be a wise one—viz., to secure for the Government the advantages which may naturally be expected from separating the improvement and maintenance of harbors and waterways from other na-

and maintenance of harbors and waterways from other national works and placing it under a separate bureau on the footing of a distinct and important speciality, to be conducted by a carefully organized corps of specialists.

The general scheme is an attractive one, but its value to the country at large will depend greatly upon the adjustment of its details, and upon the fidelity with which the spirit of its provisions is carried out. I shall have time to notice only a few of the points contained in the measure.

An important feature of this bill is the provision for retaining in the new organization the services of as large a portion as may be practicable of the United States Engineer Corps, the purpose evidently being to profit by the skill and experience which these officers have acquired in the management of just such works as the bill contem plates, and to infuse into the new organization the careful and orderly methods of transacting business which are characteristic of the army. In my opinion the bill might have gone a step further in the same direction with great have gone a step further in the same direction with great advantage, by requiring that, in the initial organization of the new corps, the chief engineer, the associate chiefs and the department engineers should be army engineers of large experience in harbor and river works, the other officers being appointed as provided for in the bill. The earlier transactions of the new corps might thus be rendered perhaps more harmonious and, certainly, less tentative in character; while the rules and regulations of tentative in character; while the rules and regulations of the old organization, so far as they may be applicable to a mixed board of military and civil engineers, could go into operation at once, and could continue in force until expe-rience shall have demonstrated the necessity for alterations. In making this suggestion, I do not mean to imply that the professional attainments of our civil engineers, within the professional attainments of our civil engineers, within or outside of their particular specialties, or their general intelligence, enterprise or faithfulness is to be rated lower than that of military engineers. Such an implication would not be warranted by the progress of civil engineering in this country. But it is a fact, I believe, that many of the older members of the engineer corps of the army are experienced in conducting harbor and river improvements in a degree which from the very nature of the existing in a degree which, from the very nature of the existing organization, must have been beyond the reach of civilian employees, though through no fault of their own. The number of civil engineers who have been brought in contact with the work of harbors and waterways in a much higher capacity than that of assistant must be extremely

small—I can think of only one. Would not the appointment of civilians to the higher offices of the new corps be therefore somewhat in the nature of an experiment, and might it not be wiser to proceed more cautiously than the bill contemplates in committing the higher duties of the corps to persons who, however high their other qualifications may be, may have only a theoretical knowledge of the routine of the business? The retirement of higher officers will in due time open opportunities to all members

of the corps to advance to higher positions.

Personally, I look with gratification, not with indifference, on the provision for the immediate appointment of civil engineers to nearly one-half of the principal offices of the new organization; but in making the preceding suggestions, I am aiming to look at the matter from a business point of view, and solely in the interest of the Government, for whose benefit alone, I take it, the bill has been pre-

If the suggestions here offered were incorporated in the bill a special commission for the formulation of rules and regulations and for the nomination of officers would be unnecessary. The regulations would then naturally be drawn up by the chief and his associates, while the same officers, if at all worthy in point of character and professional attainments to hold their positions, would, in my estimation, be quite as likely to make judicious nominations of subordinates as the special commission provided for in the bill. Moreover, they would, in all probability, be better acquainted than an outside commission could be with the necessary qualifications of appointees. The employment of a special board on rules and credentials has the flavor of civil service reform, and would be a very desirable step in organizing a bureau for conducting entirely new work. But the commission in question seems to me to be a superfluity, in view of the fact that the improvement of harbors and waterways has been carried on by the army engineers during the past fifty years on good business principles, so far as these were within their control, and, considering all the circumstances, with a very fair degree of success.

fair degree of success.

The closing provision of Section 15 supplies the necessary authority for filling vacancies in the grades of first and second assistants by the appointment of new men whenever an emergency may arise in the service rendering such action necessary. But the language of that provision admits of too liberal an interpretation. It apparently sanctions the reservation of one-third of the vacancies occurring in the above grades annually for the benefit of outside applicants, regardless of the claims of meritorious officers for promotion to these vacant positions. The law should first provide for the promotion of all officers who are really deserving, and only after that should it contemplate the throwing open of the vacancies that may be left unfilled to the competition of applicants for admission to the corps. I apprehend that the clause, as it stands, may prove to be "an entering wedge." It will tempt those who may have friends or political adherents desiring appointments as first or second assistants to use their influence for opening every year a full third of the vacancies in those grades to outside candidates without regard to the possibility that there might be in the service deserving officers yet unpromoted. This clause also apparently excludes from reappointment all former officers of the corps who, having once resigned their position, and having received an honorable dismissal, may apply tor readmission. The discrimination can be avoided by striking out the word formerly from the phrase "not formerly members of the corps."

The just regulation of promotions is a troublesome matter, and I have no doubt that the framers of the bill have given the subject much thought. Yet it does not appear to me that seniority alone should determine the advancement of the higher officers. Mr. Hering has stated very fully and clearly the arguments against it, and I cannot add to their force. But I may say that the duties of the higher officers in any organizations are not of so intangible a nature as to preclude the possibility of judging the mannet in which they are performed; that the performance of the duties of department and division engineers will admit of comparison almost, if not quite, as readily as the work of officers of lower grades; that under a proper system of observation, such, for example, as exists on some railroads, the quality of each man's work, his general efficiency, and, consequently, his fitness for being intrusted with higher duties, can be determined with great exactness; and, therefore, that there appears to be no good reason why the recommendation of the advisory board should not be made a condition for the promotion of department and division engineers. The promotion of associate chiefs could be made by the President on the recommendation of the Secretary of War, who naturally would be in possession of all the necessary intormation on which to base such recommendations.

to base such recommendations.

I think no argument is needed to show that almost any rule that may be adopted for regulating the retirement of officers from active duty will at first operate unequally in a new organization. A limit of age will probably prove, in the long run, to be a fairer basis for retirement than any other.

any other.

The bill is lacking in provisions for dealing with officers who may have become disabled while in the service; also, for ridding the corps of untrustworthy members.

In conclusion, I desire to say that the bill indicates to my mind a purpose on the part of the National Government to deal with public works on broad and advanced principles; that in the execution of such a purpose it deserves, in my estimation, warm encouragement from all quarters; that, while I have criticised some of the details

of the bill, there are many others which I heartily approve of; and, finally, that I regard the measure generally as a very important move in the right direction.

Very respectfully, your obedient servant,

CHAS. MCMILLAN.

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ROCHESTER, N. Y., March 10, 1888.

SIR: I have read with much interest both the bill and the discussion thus far in relation to the establishment of a Bureau of Harbors and Waterways, and I desire to add my mite to the support of the bill in general. The idea underlying it is the tardy recognition by the Government that engineering and scientific ability does exist outside of the graduates of West Point, and to this extent, at least, it should be looked upon as a step in the right direction. There are doubtless few earnest engineers in civil life who have not suffered more or less from just the lack of such recognition. The bill should, therefore, pass, even though all of its provisions may not be exactly in accord with our individual opinions. Much will depend upon the commission provided for by Section 12, and upon the character of the men who shall determine what the standard of a mission into the corps shall be. If this be made high enough then promotion by seniority will perpans bethe only practicable manner of filling recognities.

the character of the men who shall determine what the standard of a mission into the corps shall be. If this be made high enough then promotion by seniority will perhaps be the only practicable manner of filling vacancies.

It is very difficult to criticize a measure of this kind fairly without a thorough knowledge of the system adopted in the past. Traditions are always strong and may be respected, to a certain degree, provided that their influence is, on the whole, good. The generous rivalry between the army and the civil engineers, which will doubtless result as soon as the corps is once rationally organized, cannot fail to be beneficial, and to redound ultimately to the greater glory of a profession which, in our country, does not enjoy the general respect that is accorded to it in other lands. In the absence of anything better, let us accordingly look upon this measure with favor, and thereby secure some degree of recognition for the educational facilities and the natural talent which our country affords.

Yours very truly, EMIL Kuchling.

SELF-BURNING BRICKS.

THE following is an extract from a letter which appeared in the Peterborough Advertiser: "At Peterborough there are a number of brick-works, and the lower the clay for making bricks is obtained the less coal it takes to burn the bricks. After getting some few feet down the clay contains natural fuel, and the deeper the clay is dug the more natural fuel it contains. When the bricks made from the lower clay (which is really a shale) are being burnt, they throw out a gas which can be clearly seen burning in the kiln between the bricks. The coal bili is so much reduced since the lower shales have been made into bricks that they can be sold cheaper than anywhere else in England."

MASONRY BRIDGES OF LARGE SPAN.

ACCORDING to Professor E. Dietrich, of Berlin, in the London Engineering, there are only fifty-seven bridges of brick or stone existing having a span greater than 131 feet. Forty of these have spans lying between 131 and 164 feet, ten having spans of from 164 and 200 feet. three of from 200 to 230 feet, and one only, the Cabin John Bridge, near Washington, exceeds this limit, and has a span of 237 feet. Thirty of these are road and twenty-two are railway bridges; one carries a canal, another a conduit, and three are not classified. Fourteen of them date from before the commencement of the present century, twenty-two were built between the years 1800 and and 1860, five between 1860 and 1870, six between 1870 and 1880, and since then ten have been erected. In twenty-two of the bridges the rise lies between half and one-third of the span, in eighteen between one-third and one-fourth the span, in ten between one-fourth and onefifth the span, and in six between one-fifth and one-eighth the span. One bridge only, a road bridge in Turin, has a flatter arch than given by the smallest of the above ratios, and in this case the rise is 0.122 of the span. The radius at the crown lies in fitteen cases between 66 and 98 feet, in eight between 98 and 131 feet, in eleven between 131 and 164 feet, and in three cases between 164 feet and 187 feet 81/2 inches, the latter being the radius at the crown of the Devil's Bridge at Bevizzo, Italy. The ratio of the arch at the crown to its radius at the same point is in thirty bridges between one-tenth and one-twentieth, in ten between one-twentieth and one-thirtieth, and in eight between one-thirtieth and one thirty-fifth. In all the railway bridges this ratio lies between one-twentieth and onethirtieth, the smaller fractions being solely confined to road bridges. Twenty-seven of the bridges are situated in France, thirteen in Ita'y, ten in England, two in Austria, two in Spain, and one each in Germany, Switzerland, and the United States.

NEWARK'S WATER-SUPPLY.

THE Water Commissioners of Newark, N. J., have mace arrangements to ask the Common Council for \$450,000 to build a new storage reservoir and to increase the pumping facilities.

Superintendent George R. Gray of the Aqueduct Board says: "The city has at present the receiving reservoir, with a capacity of 14,000,000 gallons; the Chatham Street reservoir, which holds about 15,000,000 gallons; the Branch Brook reservoir, capacity 4,000,000 gallons, and the South Orange Avenue reservoir, with a capacity of 8,000,000. This makes a total of about 40,000,000 gel. lons, all of which would not be available, for when the quantity is reduced the pressure is too light to furnish the supply. The daily drain upon these reservoirs is from 17,000,000 to 20,000,000 gallons. On the basis of the lower figure the supply is scarcely sufficient to furnish the city with water for two days. Consequently the pumpmust be kept always at work, and should an accident oc. cur the city would have to depend upon the reservoir sup. ply, good for less than two days. It is proposed to spend \$150,000 in building a reservoir on the Branch Brook site. one which will hold 155,000,000 gallons, and it will be necessary also to increase the pumping facilities at Char. ham Street. This will require \$35,000 more. The remainder of the money is required for extensions, and new supply mains are needed which will cost \$165,000. The safety of the city demands instant action, for the consumption of water is constantly increasing."

The total expense is calculated to be \$450,000, but it will probably be at least half a million. The site selected for a new reservoir is the place from which the original water-supply of the city was taken. It lies along the bark of the Morris Canal, between Orange Street and Bloomfield Avenue, and was originally a natural lake nearly half a mile in length.

THE NEW TAY BRIDGE.

THE new Tay Bridge, successor to the most unfortunate piece of bridge work which British engineering annals record, was opened for general traffic on 20th June last, just five years after its commencement. The London Engineer gives the following description of this important work:

The bridge is only 23 feet less than two miles in length. or 10,527 feet. It comprises in all 86 spans, five of which are brick-work, the remainder of girder-work. Seventythree of the piers have cylinder bases, 49 of which are wrought iron, and 24 of cast iron. The piers, with wrought-iron bases, are on the straight part of the bridge. and from low water to high water are built of blue brick cylinders filled with concrete. At high water they are joined by strong connecting pieces, surmounted by octagonal wrought-iron plate pier superstructure, joined at the top by plate-work in arch form. The piers with cast-iron bases are carried up in cast iron to the connecting piece, on which the wrought-iron superstructure is erected. The girders are of wrought iron, and the maximum headway above high water is 77 feet. The total weight of wrought iron used is 19.337 tons, cast iron, 2,470 tons, and steel in flooring, 3,540 tons; or a total of 25,347 tons. Of brick-work 25,700 cubic yards were used, and of cement concrete, 37,000 cubic yards. In testing the viaduct 16 heavy locomotives were used, weighing 955 tons. The engineers for the work were Messrs. W. H. Barlow & Son. MM. I. C. E., and the contractors Messrs. Arrol & Co.. Glasgow, Mr. F. S. Kelsey, M. I. C. E., being the resident engineer.

A FRENCH VIEW OF AMERICAN TRAIN SERVICE.

M. ROEDERER, in the Annales des Ponts et Chausses, etplains the American system of train dispatching and commends it as excellent and productive of good results, but considers it the outgrowth of special conditions and requirements here, and does not advise its adoption in Europe, where, he states, the percentage of deaths and wounds from railroad accidents is only about one-fourth of what it is in this country.

THE President has approved the joint resolution directing the Secretary of the Interior by means of the Director of the Geological Survey to investigate the practicability of constructing reservoirs for the storage of water in the arid regions of the United States.





STATE SANITARY INSPECTION OF SUMMER RESORTS PROPOSED IN RHODE ISLAND.

THE Rhode Island State Board of Health make the following report and recommendation to the Legislature:

The occurrence at the Conanicut Park Hotel in Jamestown, in July, 1887, of a large number of cases of sickness, a considerable proportion of which were of great severity, and attended with fatal results in a few instances, was the occasion of early attention on the part of the State Board of Health.

The premises were visited by the secretary upon notice of the sickness there. It had been ascertained that the sickness had probably resulted from the leakage of a sewerpipe, which was the conduit of the washings of the water-closets, said leakage being in close proximity to a well under the cellar floor, and said well having been the sole supply of water for the hotel for drinking and culinary purposes.

Inquiries as to the system of drainage, location of waterpipes and connection with drains, material used, time when put in and when last examined, number and location of cisterns for washing purposes and outlets of the same, the care of outside privies, etc., elicited statements of such discrepancy as to create a belief that no person had a full knowledge of the premises and all its appurtenances.

Following the events which had occurred at the hotel there were various idle and contradictory rumors in circulation which at the best could only perplex rather than enlighten the public mind.

Under the circumstances it seemed proper that the Board should not only officially examine the premises at the Park, but also give a public hearing, so that all parties might have an opportunity of stating facts known to them, and give such individual opinions or interpretations as they believed were correct, as to the connection of the events that had transpired with the condition of the premises, and as to the responsibility therefor.

The first examination and hearing was on the 31st day of August and the second on the 14th of September, 1887.

The testimony taken at these hearings was quite voluminous, covering III pages of type-writing. The Board feel assured that it would be too tedious for the General Assembly to attend to the reading of this mass of testimony in ordinary session, and do not deem it expedient to have the whole of the same printed, inasmuch as the pertinent facts elicited, covering the questions at issue before the general public, can be stated in a greatly abridged and more concise form as follows:

On the part of the owners of the premises it was stated that "the company had not attempted to minimise the enormity of the events that had occurred: that when it appeared that the sewer was broken it was evident where the wrong was; that they felt the humiliation and sorrow of the circumstances as keenly as possible, but knew that their grief could not assuage the harm that had been done; that they did not ask that anything be covered up or any favor shown; that they believed the sewer was all right; had been in use thirteen years, the original having been put in on specification of the architects, and what were believed to be first-class plumbers employed; that they depended on the experts for good work; did not know all the details of the water and drain connections; had been informed that there would be trouble from the privies outside some future day; had contemplated putting in waterclosets in the house and discarding privies entirely and rearranging the whole plan of drainage, but had not the available means."

On the part of the lessee it was stated that he had occupied the premises several years, did not know of any defect in the drainage until 1880 a bad odor came up through the cellar and laundry floors; the floor was taken up and a waste-pipe from the laundry tubs was found broken; this was mended and the odor diminished; that he had never been satisfied with the water-supply; that he had talked with the agent several times about it, and that it was well understood that in the spring of 1887 new and ample water-supply would be furnished and the drainage

entirely overhauled; that he came about the 1st of June, nothing unusual about the water was discovered until the 9th of July. On the 10th the pump from the well was tied up and no water taken from it afterwards; the sickness of the boarders, however, continued to increase in number and severity, and they began to leave, and by July 23 all were gone. On the 23d the cause was definitely determined.

The testimony of practical plumbers was to the effect:

That the old plumbing was bad work, materials bad, joints badly cemented, sewer of vitrified pipe running through the wall, broken both sides of wall and at a joint three lengths from the soil-pipe; traps of water-closets plugged in the iron soil-pipe with wood; overflow-pipe from a cistern had entered the soil-pipe and sewer without a trap, but had been plugged.

Believe the well was polluted by sewage from the leaking sewer or drain pipe.

Dr. Jernigan, of Boston, testified substantially:

That from the testimony of others, and from personal knowledge of certain unsanitary conditions, he was positive that the sickness was caused very largely, if not wholly, by the use of polluted well-water, and that the pollution of said well-water was caused by the inflowing of sewage from a broken drain-pipe or sewer.

From the examinations made and the evidence presented at the public hearings, the Board came to the following conclusions:

That the sickness at the Conanicut Park Hotel was caused by the pollution of the well-water which had been in use.

That said pollution was caused by leakage from a broken sewer-pipe.

That the said sewer-pipe was of brittle material and that the connecting joints were cemented by material that had become brittle and crumbly.

That the sewer pipe had been in use thirteen years and had not been inspected during that time.

That the sewer-pipe was broken both sides of the wall through or under which it emerged from beneath the building, and that said breakage had probably been in existence to some extent for several years.

That there had been foul smells in the cellar beneath which the sewer-pipe was laid and in the laundry adjoining during the year 1886, and upon examination a drain-pipe from the laundry tubs running to the sewer was found broken several feet from the connection with the sewers. The broken drain-pipe was mended and no further examination made.

That the connection of the drain-pipe with the sewer was very loose and had probably allowed the leakage of wash-water when flushed for a number of years.

The Board is further of the opinion that there had been an almost entire and inexcusable lack of proper knowledge on the part of the owners of the quality or condition of the main sewer and the arrangement and condition of the soil and water pipes, and of their dangerous relation to the well.

That there had been on the part of the owners a culpable neglect of proper inspection and supervision from year to year of the drainage, water-supply, and other sanitary requirements of a summer hotel.

And further, that there are other summer hotels and boarding-houses in the Stare in which and around which the sanitary conditions are such that disastrous events, like those which occurred at Conanicut Park Hotel, may ensue to a greater or less extent in any or every year indefinitely.

The Board, therefore, would recommend such legislation as will, as far as possible, secure a thorough sanitary examination of all premises that are opened to the public for the accommodation of summer boarders, and thereby furnish healthful homes to seekers after recreation and health, rather than unsanitary traps to catch confiding visitors, and promote disease instead of health, and respectfully submit the accompanying act therefor:

SECTION I. The State Board of Health shall cause an examination of such buildings and premises connected therewith as may be opened in this State for the board and lodgment of summer visitors or summer patrons and furnishing accommodations for ten or more such persons at one and the same time. Such examination shall be made under the direction and supervision of the said Board and by employees under its appointment and at such times as the said Board shall deem necessary.

SEC. 2. The said employees or sanitary examiners so appointed shall ascertain the source and sufficiency of the water-supply and the quality of the water, the methods of removal of waste water, slops, excreta, house refuse, gar-

bage and all putrescible matter of whatever kind, the ventilation available, the means of preventing and modes of safe escape in case of fire, and such other conditions, as per schedule furnished, as the said State Board of Health shall require. The said examiners shall receive for such service such compensation per diem as the said Board shall deem just and reasonable.

SEC. 3. Upon the receipt of the report of such examinations the State Board of Health shall authorize the Secretary of said Board to issue a certificate certifying to the sanitary and other conditions of the examined premises in accordance with the examiner's report, and said certificate shall be placed by the managing occupant of such premises in a safe and conspicuous place where it may be easily seen and read by all persons visiting said premises, and the said managing occupant upon the destruction or defacing of such certificate shall immediately procure another of the same character, to be placed in a like conspicuous position.

SEC. 4. Every person opening a hotel or other building for the purposes set forthin Section 1 of this chapter, who has not previously requested or obtained an examination of said premises in compliance with the provisions of this chapter, shall be fined not less than \$50 nor more than \$500; or imprisoned not less than thirty days nor more than three years.

SEC. 5. The sum of \$1,500, or so much thereof as may be needed, is hereby appropriated for the purpose of enforcing the provisions of this act, and any bills for service or expense incurred in such enforcement, when certified by the Chairman of the State Board of Health and approved by the Governor, shall be paid from the State Treasury upon order of the State Auditor.

SEC. 6. All acts and parts of acts inconsistent herewith are hereby repealed, and this act shall have effect from and after its passage.

THE HISTORY AND ART OF RAISING WATER.

A Lecture before the Plumbing Class of the New York
Trade Schools.

A LECTURE was delivered before the plumbing class of the New York Trade School March 15, by Mr. Thomas J. Rider, Superintendent of the Delamater Iron Works, who briefly outlined the development of the art of water-raising from the earliest times until our own day, and explained some of the special and fundamental principles and devices.

Mr. Rider traced the progress of this art (which he believed so important as to be a fair indication of civilization) from its probable beginning in the use of a gourd dipper. From the gourd the first artificial vessels for raising and carrying water were modeled; then, as wells were dug of increasing depth that became inaccessible from the surface of the ground, inclined planes were made to descend to the water-level, and when these became too long or steep, spiral stairs were built in the well itself.

Where the stairs were not used a vessel was probably lowered by a cord, and from this germ the "chain of pots" was evolved that still exists in a slightly modified form as a chain pump.

The cord with a single vessel was soon provided with a pulley, and then another vessel or bucket was attached to the other end. This was the first machine used for raising water, and was very soon supplemented by a windlass. The well sweep was also introduced and still performs effective service under suitable conditions.

Increasing demands for water, especially for irrigation, led to the invention of pumps, which may be divided into two classes—lifting pumps that work by suction alone, and those that also force the water above their own levels.

The surface of all water sustains an atmospheric pressure of about 15 pounds per square inch (increasing rapidly with its distance below and decreasing slowly with its distance above sea-level). If this pressure be removed from a certain portion, as is done in the barrel of a suction pump, the water is unbalanced and the pressure on the remainder will force it up there until the height of the column is such that its weight equals the pressure on its base. This height is theoretically a little more than 32 feet at sea-level; in ordinary practice about 20 feet is attained, 25 feet is considered as high as practicable, and 30 feet as the absolute working limit.

The ordinary cistern or pitcher-pump has a metallic barrel with a tightly fitting sucker or bucket in it, and there are valves in the foot of the barrel and bucket. Raising the bucket removes some of the air-pressure from the water below, which flows up through the foot-valve into the barrel of the pump. When the bucket is depressed its valve opens and allows it to descend through the water in the barrel; again raising the bucket lifts the water already in the barrel and sucks in more under the bucket, and so on for every stroke. This pump is called single-acting

all the work being done by the up stroke of the bucket piston. If the pump is far above the water the first strokes will draw air only from the pipe, gradually lifting the water towards the barrel, which it will enter and then be continuously discharged. If the pump be placed above the limiting height of suction, water can only be raised to that height in the pipe and will remain there, further pumping being useless.

The bucket of this pump is usually made of two pieces of metal, with a cup-shaped leather packing between. The bucket-valve is metal, ground to fit. The foot-valve is soft leather, working like a hinge, and is loaded to close it tightly. A stem on the bucket-valve and lever on the foot-valve open them while the bucket is at the lowest part of its stroke and insures the drainage of the water from the pump when not in use.

This pump becomes a single-acting force-pump by the addition of an air-tight cap, through which the pump-rod works in a stuffing-box, and a discharge-valve which is placed above the bucket, and is a counterpart of the foot-valve. The water raised by the bucket is forced into the discharge pipe through this valve, which closes and prevents its return to the barrel when the bucket descends. The next up-stroke of the bucket forces more water through the discharge-valve, raising the level in the discharge-pipe, and so on until it rises to the required height and reaches the outlet, when the discharge will correspond to the strokes of the bucket.

Force-pumps are generally made double-acting— $i.\ e.$, to throw the water at each stroke. The bucket is replaced by a solid piston, four valves are required, and the footvalve is called a suction-valve. A common single-acting force-pump, used for pumping against heavy pressures, feeding boilers, etc., has the bucket replaced by a solid plunger passing full sized through the stuffing-box and loosely fitting the barrel. This pump cannot raise the water far by suction.

The bucket-plunger pump is like the single-acting bucket force-pump, except that the pump-rod is so large as to occupy just one-half the volume of the barrel, so that on the downward stroke of the bucket the water occupying the whole space of the barrel flows through the bucket-valve, and having only half room enough above it one-half is forced out through the discharge-valve, and the remainder being forced out on the up-stroke keeps up a constant discharge and makes the pump single-acting in suction and double in discharge. This is of great advantage for a long or crooked discharge-pipe and this pump is much used for artesian wells and other places. Besides the above, which are the principal forms, many other pumps are now made.

Rotary pumps of whatever pattern have parts which correspond in use to the foot-valve, bucket, cylinder, and discharge-valve, and are extensively made, but not in such numbers as the reciprocating pumps. Usually they are more delicate than straight-motion pumps, but often have the advantage of occupying little space and discharging a continual flow of water at a high speed.

There are three essential elements of the power required to raise water—viz., the weight lifted, the distance to which it is lifted, and the time it takes to lift it. A strong man, working to his full capacity, is able to raise 4,000 pounds one foot high in one minute; 33,000 pounds raised one foot in one minute is the standard horse-power. A gallon of water weighs 8½ pounds, and a man working at his maximum capacity could raise 300 gallons 100 feet high in one hour, provided there were no losses from friction; but these losses are so great in practice, that frequently the water raised represents only one-third or less of the power developed. One great source of loss is in the considerable speed at which water is frequently delivered.

As civilization has advanced, the power for raising water has been succesively furnished by manual labor and animal labor, and steam, gas and hot-air engines. We have large pumping-engines raising millions of gallons of water daily, and we have the smallest steam-pumps, but all may be classified either as simple or duplex pumps.

The direct-acting steam-pump differs from a steam-engine in having no crank or fly-wheel, and no part makes a revolution. The steam-cylinder is at one end of the apparatus and the water-cylinder at the other, and the steam is admitted alternately to the opposite sides of the piston; the inlet and outlet valves of the steam-cylinder are generally automatically worked by the steam itself, and

these small engines are usually efficient, and more used in this country, at least, than all other kinds together.

In the duplex steam-pump two pumps are combined so that the piston of one controls the steam-valve of the other.

These small engines are very popular, and are unequaled where there is enough pumping to require steam-power. Their valve motion is simple and positive, and the speed of discharge is practically constant.

Where steam-power or skilled attendance is inadmissible, gas pumping-engines may be used. These derive their power from the explosion of a certain mixture of air and illuminating gas, which is injected in the cylinder, and drives the piston. Continued action is maintained by a heavy fly-wheel, which sustains it from one impulse to the next, which may be one, two, or three revolutions apart. The chief advantages of these engines are the ease and rapidity of starting and absence of dust, ashes, etc., but they are apt to get out of order easily, and require a constant uniform quality of gas.

Hot-air pumping-engines are very simple, perfectly safe, and their care requires no skill and little attention.

Some points should be especially considered regarding the pumping of water for domestic use. With a singleacting pump, particularly if run fast, every pulsation is sure to be heard.

If we place an air-chamber on the pipe at every upward stroke the water enters the bottom and compresses the air in the upper part; when the piston descends the air expands and forces the water out in a comparatively steady stream without the shocks otherwise caused. Frequently more than one air-chamber is necessary on a long discharge pipe.

A similar chamber, called a vacuum-chamber, although it should be filled with air, is often used on the suction-pipe for the same purpose as on the discharge-pipe.

The air-chamber sometimes becomes filled with water and must then be resupplied with air, which is generally easily accomplished by opening a pet-cock and allowing some air to be pumped with the water. A pet-cock should never be soldered to the top of an air-chamber, for it is impossible to make it tight and the air escapes through it.

If a cock is necessary to draw water out of an air-chamber place it in the lower part and make it large enough and there will be no difficulty.

Fresh water contains a large amount of free air which generally supplies the air and vacuum chambers of a pump, but in pumping water over and over from one tank to another, as in some hydraulic elevators, this air becomes eliminated. The water is slightly warmed by friction, loses the air as it leaves the pipe entering the tank, and becomes as solid and unyielding as a bar of iron, making it generally difficult to keep a pump running smoothly at such service.

The larger the pipe the easier it is to pump a given quantity of water through it in a given time, because the friction is less than for a smaller pipe.

The power required depends on the size of the piston and the height to which the water is forced. Elbows, particularly those of 90°, should be avoided when possible, and the size of the pipe be made such as to give a speed of five or six feet per minute to the water. When there is danger of an insufficient water-supply, a reservoir should be introduced between the street-main and the suction-pipe. This reservoir should be as near the pump as possible and a large pipe may often be neatly and advantageously used for the purpose.

Mr. Rider concluded his remarks by the explanation of a hot-air pumping-engine which was exhibited in the class-

CUP VERSUS WIPED JOINTS.

105 BLEEKER STREET, TORONTO, March 14, 1888.

SIR: I have noted Mr. Billings' reply to my letter. I have no records of any tests as to the relative strength of the joints in question.

the joints in question.

Like Mr. Billings, I have to rely on my experience (some 14 years) as the basis of any opinions I may have in this connection. One has only to compare the two joints to see that the wiped joint is superior in every respect. Granted that the bond of the lead to the brass to be perfect, and not subjected to changes of temperature as is the case with hot-water pipes, there is still in the cup joint the weakness caused by opening the pipe to allow the insertion of the tail piece or coupling, which would be further aggravated in the connection of lead pipe with lead pipe; again, in the event of it being necessary to bend the pipe close to the coupling or solder-nipple the tendency would be to strain the pipe at its weakest point, which is the

shoulder formed by opening the pipe at C; D shows a wiped joint similarly treated. The lap feature may be added to the wiped joint as shown at A, held and strengthened by a "perfect cement." B shows an ordinary wper joint. Now, I think that Mr. Billings and most of yet readers will concede superiority for the wiped joint as to strength

Now let us consider its durability under changes of temperature, such as occur in hot-water pipes. In my experience I have never seen a wiped joint opened at the edges as Mr. Billings describes. I have, however, seen joints melted off on water-back connections where in a water-famine the water in the boiler was below the side coupling. This was evidently caused by steam generated in the water-back, probably superheated, and as wiping solder melts at 475° and fine solder, such as is used for making cup joints, will melt at 360°, it will be seen that in this case the advantage is with the wiped joint. The lead may sometimes crack at the edges of a joint which mighs be attributed to two causes: (1) the crowding together of joints on hot-water pipes, not allowing sufficient room for expansion between them; (2) the pernicious practice some young plumbers have of trimming their joints on the edges, leaving a cut in the lead, which by the constant expansion and contraction gradually opens. With regard to the unequal expansion of the solder, the lead, and the brass, I find that under a change of temperature from 40 (cold water) to 212° (boiling water) lead will expand I in 368; wiping solder will expand I in 482; and from this it is shown that the inequality of expansion is principally between the lead and the brass. The expansion of the lead and wiping solder is more equal than would be the case with fine solder containing, as it does, more tin, which is less expansive.

Let us now consider the effect that such changes of temperature would have on the cup joint. As the lead expands the tendency will be for the weakest portion of it to give way, the frequent repetition of which must cause a fracture at that point.

I entirely agree with Mr. Billings as to "cheapness properly understood" being good argument, which, I take it, means "the best is the cheapest"; and as the wipedjoint is the best, it is, therefore, the cheapest.

Respectfully yours, BENJAMIN KIRK.

PHILADELPHIA MASTER PLUMBERS' ASSOCIATION.

THE Master Plumbers' Association met March 9. After the transaction of routine business, Mr. John E. Eyanson called the attention of the association to the fact that the testing of soil-pipes by either peppermint, pressure (water or air), or smoke was being agitated in the newspapers, and he thought it proper for the association to examite the several tests and report which, in its judgment, is the proper one for the plumbers of Philadelphia to adopt.

On motion the subject was referred to the Sanitary Committee, with instructions to invite the entire association when the experiments are made.

The Sanitary Committee propose meeting this week and without delay attend to the work which the association has assigned to it.

HOW MANY GALLONS IN A CYLINDRICAL TANK.

JOHN F. WARD'S rule for the number of U. S. gallons of 231 cubic inches contained in a cylindrical vessel is to multiply the square of the diameter in feet by the length or height in feet and divide by 0.17. This will be found to be a very close approximation, its error being less than that due to ordinary changes of temperature. If only a rough approximation is desired, say within two per cent. it will be sufficient to multiply by 6 instead of dividing by 0.17.

A NOVEL BOILER-FEEDER.

If an open tank be placed on top of a steam-boiler with a short connection closed by a stop-cock communicating with the steam-space, and the tank be filled with cold water and the stop-cock opened. the water will rush into the boiler no matter what the steam-pressure may be inside

This statement we have recently seen in some publication whose name we cannot now recall.

The explanation would seem to be that the steam in contact with the cold water is so instantaneously condensed that it has no time to exert any pressure against it, and hence cannot oppose its entrance.

The water really surrounds itself with a vacuum or vacuous film into which it rushes as into an exhausted receiver. The principle is very much the same as that of the injector.

We should warn our readers to use great caution in repeating this interesting experiment, as 'the rapid fall of pressure in the boiler due to the sudden condensation of so much steam is liable to cause violent and even dangerous ebullition.



Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

HOT-WATER HEATER.

MESSRS. RICHARDSON & BOYNTON Co., 232 Water Street, New York, are just placing on the market a new hot-water heater, which is herewith illustrated. The cut clearly indicates the principle of construction.

It is made in sections, the flame passing upwards through the hot-water tubes, which are staggered. The connections between each section is alternately front and



rear. The water entering the lower section must pass through each one above before entering the house system. Plates are placed partially over the three centre openings in the top section, immediately below the smoke outlet, for the purpose of diverting the products of combustion and retaining the heat. The grate is the same as is used on the hot-air furnaces made by this firm.

ENGINEERS' SOCIETY OF WESTERN PENN-SYLVANIA.

AT a regular monthly meeting of the Engineers' Society of Western Pennsylvania, held at the rooms of the society, March 20, Professor J. A. Brashear acted as Chairman and Captain A. E. Hunt as Secretary. Three new members were admitted. Mr. J. F. Bray, being present, opened the discussion on his paper on the "Welding of Steel Tubes," which was read at the January meeting, but on which discussion was postponed until he could be present.

Mr. Bray brought with him a large number of samples showing what could be done with the steel from which the tubes were made. He stated that the making of steel tubes was not a new industry, as lap-welded tubes have been made for the past twenty years. But as they always had been made of a high grade of steel, a fine article, the price interfered with their use. He had at first objected to the use of steel, believing it unsuited for the purpose, but his experience had shown him that the steel they were using was far better than iron. They had yet to receive a complaint. complaint.

There was no trick or flux in the matter of welding.

Moreover, the steel stands more heat than iron, more abuse in the furnace, and will not waste as much.

He exhibited samples of steel pipe that had been frozen six times and thawed out, and there was no sign of a burst. Iron pipe, tested in the same manner, had split to pieces

As to bending, his experience was to the effect that steel bent better than iron. In the matter of threading, the smaller pipe are threaded at a higher speed than iron, from smaller pipe are threaded at a higher speed than iron, from 20 to 22 feet per minute, while on the larger sizes we taper down to 12 to 14 feet per minute. The very best material is used for dies, lubricating well with the best lard oil. In the matter of cost of repairs to dies the difference has been noted between the steel and iron pipe. He believed a better thread could be cut on steel than on iron pipe. Mr. Barnes stated that he could not be persuaded that the success obtained in the welding was not due to expertness or skill in the manipulator.

Mr. Bray replied that a number of the samples exhibited had been formed by a boy of 17 or 18 who certainly was not an expert.

was not an expert.

Mr. Metcalf stated than when boiler-tubes were first made crucible steel was employed, which was very expensive. Then the steel suitable for the purpose was gauged by the carbon, which was about .25 per cent., the steel being as free from impurities as it could be made. He still thought, in spite of what had been shown, that there

is a distinction between the manner in which steel welds and that in which iron welds. When separated the iron and that in which iron welds. When separated the iron is shown torn out in fibres, and then interlacing, while steel, when possible to separate it in the weld, always shows a smooth surface, so that seriously the expression "stuck together," as employed by Mr. Bray, was more appropriate and more expressive of the actual condition as applied to steel than the term "welding." Steel does not weld in the sense that iron welds, where the fibres inter-

/ Mr. Koch spoke of his experience in England where, on more than one occasion, when plates came out too narrow or too short, they had welded them to the proper dimensions. This had been done, too, in the case of shafts, and he knew of cases now where these materials had been and he knew of cases now where these materials had been and are now being employed on Atlantic steamers. That, so far as quality was concerned, any kind of steel could be welded. He exhibited a sample of Clapp-Griffith steel pipe tied into a knot, and stated that equally as good results could be obtained with open hearth or Bessemer. That in his experience they had welded every kind of steel, from .02 to 1½ per cent. manganese, and from .05 to .60 per cent. carbon.

Captain Hunt then gave the results of two analyses of the steel used by Mr. Bray in making the tubes, one by him-

steel used by Mr. Bray in making the tubes, one by him-self, the other by Mr. Wood, chemist of Carnegie, Phipp & Co., which were:

	Hunt,	Wood.
Carbon. Mar gauese. Phosphorus Sulphur. Sulphur.	.05 .38 .105 .059	.06 .36 .09 .074 Not taken

The material has a tensile strength of 55,000 to 60,000 pounds, an elastic limit of one-half the ultimate, an elongation of 25 per cent. in 8 inches, and a reduction of area

of 50 per cent.

The discussion then closed to hear the reading of a paper by Professor F. C. Blake on "The Electrolytical Separation of Gold and Silver."

The paper was an interesting one, though quite technical.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

AT a regular meeting March 21, Treasurer George S. Green presiding, the secretary read a paper by Edward Prince, Mem. Am. Soc. C. E., upon a 30-inch wooden conduit designed and constructed for the Quincy, Ill., Water-Works

The conduit connected the iron water-pipe on shore at the pumping-station with the point of supply at a crib I,480 feet away in the Mississippi River, and was built in three sections of 540, 548, and 400 feet each, towed out to position, launched, then connected, ballasted, and sunk

to position.

The secretary was requested to ask Mr. Prince for fur-The secretary was requested to ask Mr. Prince for further data than was embodied in the very brief description. It was thought that in some parts of the Mississippi the current would scour underneath the conduit and soon let it down many feet, effectually protecting it from navigation, ice, etc, and inquiry was made whether the increased length that would be required for the elongation of the

conduit had been provided for.

A circular communication on "Increasing the Durability of Timber," from the Forestry Division of the U.S. Department of Agriculture, was also read. The cause of decay, comparative durability of different kinds of wood, time for felling, and subsequent treatment were briefly explained. plained.

A paper by Mr. Emil Kuichling, M. Am. Soc. C. E., giving some data translated from the Deustche Baug Zeitung concerning surface drainage and flow in sewers. The paper was presented in the discussion of Mr. McMath's recent paper, and an earnest request was made for the recording and publication of further observations; these, Mr. Rudolph Hering stated, to be now in progress both in Washington, Philadelphia, and New York, where carefully measured areas have been selected and provided with automatically registering rain-gauges and the sewers with a system of velocity-floats for recording the velocity at different depths of flow.

ferent depths of flow.

The secretary announced the death on the 15th inst. of Squire Whipple, Hon. M. Am. Soc. C. E. Mr. Theodoie Cooper spoke of Mr. Whipple's able professional career, that was founded on natural ability and earnest work, unaided by special preparation or early technical education. He developed the theory and practice of iron bridge building and just attained the simplicity of design and effectiveness of construction that permits an exact mathematical calculation of strains in every member and reduces the structure to the skeleton of the strain diagram. He wrote, printed, and published the first book on bridge building that pre ents the accurate and practical principles building that pre ents the accurate and practical principles on which our present practice is founded, and he was essentially the "father of bridge building."

It was moved, seconded, and carried that the president

be authorized to appoint a committee to prepare a memoir of Mr. Whipple for publication. Mr. L. L. Buck suggested that the memoir contain a sac-simile of the origina edition of Mr. Whipple's book and an illustration of the model truss, now in the society's possession, by which the fundamental propositions were just demonstrated, suggestion was referred to the committee.

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE annual meeting of the Boston Society Civil Engineers was held March 21 in the parlors of Young's Hotel. neers was held March 21 in the parlors of Young's Hotel. After listening to the annual reports of the governing and the special committees, balloting was had for election of officers for the coming year, with the following results:

President, D. Fitz Gerald; Vice-President, F. P. Stearns; Secretary, S. E. Tinkham; Treasurer, Henry Manley; Librarian, H. D. Woods.

After transacting some other business matters, the meeting adjourned to the large dining-hall to partake of the annual dinner.

annual dinner.

There were present as guests of the society: Messrs.
J. J. R. Croes, Vice-President American Soc. C. E.; George
G. Crocker, Chairman Mass. R. R. Commissioners; E.
P. Fisk, Chairman Legislative Com. on Drainage; Joseph
A. Wilson, President of Engineers' Club of Philadelphia;
H. M. Howe, Vice-President Am. Inst. Mining Engineers:
A. V. Abbott, Chief Engineer National Superheated
Water Co.; J. N. Louder, President New England R. R.
Club; E. R. Jones, late Superintendent Eastern Division
B. W.W.; M. L. Holman, President St. Louis Engineers'
Club. Besides these there were 18 other guests and 77 Club. Besides these there were 18 other guests and 77 members present.

After partaking of the viands prepared for them the company were favored by speeches from Messrs. Croes, Crocker, Fisk, Wilson, Howe, Holman, Louder, Fitz Gerald, F. P. Stearns, Clemens Hershel.

MAGNESIA IN PORTLAND CEMENT.

23 LIBERTY STREET, NEW YORK,) March 12, 1888.

SIR: In your last issue you quote from the London Engineer regarding expansion of Portland cement after setting, which is due to an excessive quantity of magnesia, and I have for some time insisted that engineers should and thave the insisted that engineers should not depend exclusively on the tensile strength of cement at seven days' age, but should consider its analysis at the same time and reject all cement that contains over one and one-half per cent. of magnesia as dangerous to use in concrete construction.

Analyses of different Portland cements showed that "Gibb's" was peculiarly free from magnesia, the highest percentage present being .79, and the lowest .46, giving a mean of .62.

Chemical analysis is of great importance since the intro-duction of slag cement sold as Portland, and to the use of it is now attributed the failure of several concrete works.

A simple test for slag cement is to place upon a clean silver coin a thin layer of cement, dropping thereon a small quantity of dilute sulphuric acid (one acid to seven water), and afterwards rinsing with water. If the cement is genuine Portland the treatment will only slightly affect the color of the silver; if there has been adulteration with slag a dark brown stein will be produced white class. slag a dark brown stain will be produced, whiist slag cement turns the silver almost black.

Yours truly, HOWARD FLEMING.

AN ADDRESS WANTED.

WALTHAM, MASS., March 14, 1888.

SIR: Will you please inform us, if it will not inconvenience you too much, who makes W. Scarborough's trap and where a letter would reach him, and has he obtained a patent on it? It is illustrated in W. Paul Gerhard's book on "Drainage and Sewerage."

KNAPP & KIRWIN

KNAPP & KIRWIN.

[Referred to our readers.]

HOW WILL DAMMING THE NIAGARA RIVER AFFECT LAKE ERIE?

MAYOR'S OFFICE, VERMILLION, O., March 10, 1888.

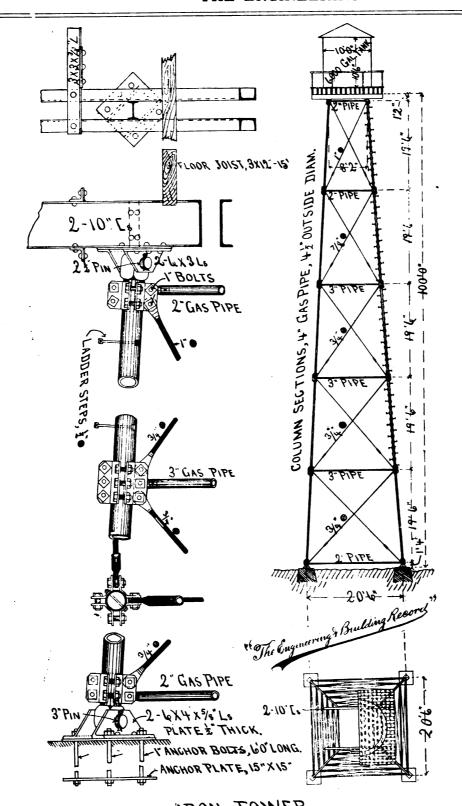
SIR: If a breakwater should be built across the Niagara River at Buffalo of sufficient height to raise the water four feet at the port of Buffalo, would the same or nearly the same rise take place the whole length of Lake Erie?

Please give me your opinion and oblige,

B. S. HORTON.

[The only cause of the flow of water in streams is a difference of surface level, to which, or better to the slope of the surface, the velocity of the flow always bears a certain proportion, other things being equal. The only cause that retards the flow due to a difference of level is the resistance due to the friction of the stream in its bed, which will obviously be proportionately greater as the stream is shallower. Hence, the velocity of a stream will be proportional both to its slope and to its depth, and if the velocity of a stream is decreased, either its slope or its depth or both must have been reduced, and if one of these factors has been increased while the velocity is reduced, then the other must have been reduced in still greater proportion.

Lake Erie baving a current through it and being of approximately uniform width, is practically a portion of a stream and subject to the laws above stated. Since its depth is great and the velocity of its current very small, it follows that its slope must be very sign, that its level practically level. If, therefore, its level be raised four Digitized by follows that its slope must be very slight, that in fact it is



TRON TOWER ELEVATING 6,000 GAL, WATER TANK. BUILT FOR GEORGE DULLING, SAN ANTONW, TEX. AND DESIGNED BY THE DETROIT BRIDGE AND IRON WORKS.

feet at its outlet by a dam at that point the level of the whole lake will practically be raised the same amount. Since, however, the amount of water flowing through it will not be changed, it follows that the velocity of the current will be reduced in the proportion that its crosssection has been increased by the additional depth.

But, as above stated, if the velocity is reduced while the depth is unaltered or increased, then the difference of level or slope of the surface must have been reduced as well, consequently the level of the upper end of the lake will be raised something less than four feet, but as the lake was practically level before, the decrease in the difference of level will be an almost imperceptible quantity, perhaps too small to be detected by the most careful leveling. We may therefore expect a dam to raise the lake-level with practical uniformity at all points.

Winds blowing lengthwise of the lake often make a difference of several feet in the level of the water at its ends, and on one occasion, just after a strong westerly wind had raised the water at the eastern end and thus forced out an unusual amount through the Niagara River, a strong

easterly wind set in, forcing the balance to the head of the lake and lowering the water at the outlet to the bed of the river, which, of course, stopped its flow, so that for some hours it was possible to walk across just above the Falls, and several persons did so.]

WATER-TANK TOWER OF WROUGHT-IRON PIPE.

For elevating a small private water-tank to a considerable height, this tower presents a simple and inexpensive design. The pipe struts and columns are joined by wroughtiron sectional clamps, which with the turned end plugs make light, but strong connections. All the diagonal rods have forged heads for pin connections, and are adjusted by sleeve-nuts on upset screw ends.

The structure presents a minimum surface for resistance to wind, and is anchored at each column foot to the masonry foundation.

This tower, now in use in San Antonio, Tex., was designed and built last year by the Detroit Bridge and Iron Works.

THE ARTHUR KILL BRIDGE.

A MEETING of the Board of Army Engineers, appointed by the Secretary of War, was held during the past week to hear testimony in regard to the proposed Kill-Von-Kull bridge, between Staten Island and New Jersey. The Board consisted of Col. T. L. Casey, Lieut. Col. H. M. Robert, Lieut.-Col. P. C. Hains, Major W. R. King and Capt. Edward Maguire.

Capt. Edward Maguire.

Ex-Senator Sewell in behalf of the Pennsylvania Railroad Co. stated that the Arthur Kill was one of the chief waterways on the coast. The point at which the bridge is being constructed is only 700 feet wide, and the annual tonnage aggregates 10,000,000 tons. He declared that the opposition was simply to protect navigation. The towing rate from Amboy to New York Bay did cost about 5 cents a ton, but owing to the obstructions in the channel since work on the bridge was begun the rate has been increased to seven cents. This means \$420,000 annually, and falls on the railroads that are obliged to use the waterway. Chief Engineer Richards, of the Pennsylvania Railroad, submitted a map of the Arthur Kill and statistics to show how towing had been hampered. He suggested that the bridge should be not less than 70 feet above high water and consist of a single span. Senator Chase, who is superintendent of the single span. Senator Chase, who is superintendent of the towing interests of the Pennsylvania Railroad, gave it as his opinion that the bridge pier is an obstruction to navi-

An affidavit by Robert H. Sayre, Second Vice-President of the company, stated that Perth Amboy is now the main coal and freight terminus of the company, which has expended over \$2,000,000 on it, and the coal and freight moved annually over the waterway is about 2,250,000 tons. If the bridge is built as proposed he would deem it his duty to advise the company to cease further development of Perth Amboy and endeavor to secure some other location for its business.

Mr. H. Haley, of the Brotherhood of Steamboat Pilots, said that the organization had adopted resolutions favorable to the plan. Mr. Haley said the trouble was that the large tows sent through the Kill by the rivals of the Balting town sent through the sent thro more and Ohio practically monopolize the stream to the detriment of private tows, and are a nuisance.

Colonel Casey announced that the board would report

to the War Department.

GEORGE W. CASS.

GEORGE W. CASS.

GEORGE W. CASS, who was generally known as "General Cass," died in New York on March 21.

Mr. Cass was born in Muskingum County, O., in 1810.

His father was a brother of General Lewis Cass. He was graduated from the West Point Military Academy with the class of 1832. He served on the North-westem frontier, and resigned from the army in October, 1836.

He was appointed by President Jackson as one of the engineers to construct the great national road, and was engaged in that work until it was completed through the States of Maryland, Penmsylvania, and Virginia. In the course of this enterprise he constructed the first cast-irod bridge ever built in the United States over Dunlap's Creek, a tributary of the Monongahela River. A company was then organized for the improvement of the channel of the Monongahela. He became the engineer and after may discouragements the enterprise was carried to a successfunl issue in 1844. In 1849 he established the Adams Express across the mountains from Baltimore, effected the consolidation of all the company's large that the restablished the Restablished the Restablished the Cass of St. Levis and south to Rich. lished the Adams Express across the mountains from Baltimore, effected the consolidation of all the company's lines between Boston and St. Louis and south to Richmond in 1854, and was rewarded in the following year by being elected first president of the united company. Though elected president of the Ohio and Pennsylvania Railroad in 1856, he continued to direct the affairs of the Adams Express until 1857. In the same year he became president of the Pittsburg, Fort Wayne and Chicago Railroad, which office he held for twenty-six years.

THE following changes are ordered in the stations of officers of the engineer corps: Maj. L. C. Overman will relieve Maj. S. M. Mansfield as engineer of the Tenth Light-House district, who will then relieve Capt. D. W. Lockwood; Capt. Lockwood will then proceed to West Point to assume the duties of instructor of practical military engineering and as commanding officer of Company E. battalion of engineers, relieving Capt. P. M. Prick, who will go to the office of the chief of engineers at Washington; Capt. W. L. Marshall will relieve Maj. Thomas H. Handbury as engineer officer of the division of the Missouri, and the latter will proceed to Portland, Ore., relieving Capt. C. F. Powell as engineer of the Thirteenth lieving Capt. C. F. Powell as engineer of the Thirteenth Light-House district; Capt. Powell will then take station at Memphis, Tenn., relieving Capt. W. T. Rossell.

CITY ENGINEER ROBINSON, of La Crosse, Wis., has resigned his office and will go to Chicago.

DOMINGO J. CARTAYA, a civil engineer employed by the Nicaragua Canal Company, died at San Juan del Norte on March 14.

EDWARD D. BOLTON, C. E., for many years in the employ of E. D. Bouditch, C. E., of Boston, has become a member of the firm of T. William Harris & Co., engineers and contractors of New York neers and contractors, of New York.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

THE MAINTENANCE AND OPERA-TION OF WATER-WORKS BY PRIVATE CORPORATIONS.

PRIVATE CORPORATIONS.

Under this title Messrs. A. H. Howland and George A. Ellis, Civil Engineers, 71 Equitable Building, Boston, Mass., have produced a pamphlet describing a series of blank books which they have published intended for use by private water companies in keeping their accounts. Included in this pamphlet are suggestions regarding the method of keeping water-works accounts. We presume the pamphlet is intended for gratuitous distribution. It will be suggestive to water-works officials.

ARCHITECTURAL COMPETITIONS. STONE LAKE, IOWA.—Plans are wanted here until April 1 for a court-house. Address J. W. Warren.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-viii-260.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

NOT JOHN W. HILL, M. E., OF CINCINNATI. MR. JOHN W. HILL, M. E., of Cincinnati, is not the John W. Hill referred to in this item published last

week:

"Harper, Kan.—It is reported that the town authorities have refused to accept the water-works constructed for it by Mr. John W. Hill."

South Framingham, Mass.—Concerning the reported water-works project here, we have received the following communication from Frank E. Hemenway, Town Cierk: "The water-works have been in operation some three years. They are operated by an incorporated company called 'The Framingham Water Co., Willis M. Ranney, President.

CLYDE, N. Y.—The water-works project here is explained by E. W. Sherman, the Town Clerk, in the following communication to us: "No action has been taken in relation to water-works in this village. There have been parties here from Buffalo and also from Water-town, but the retiring Trustees did not feel like taking any action, and the newly elected ones, I hardly think, would favor the project. There seems to be but a few who are favorable to it on account of the heavy tax it would saddle upon the village."

KEYPORT, N. J.—Concerning the report that water-works were to be established here, we have received the following letter from Town Clerk C. H. Cook: "A man, representing a New York party, was in town a short time ago agitating the question of water-works, but nothing has been done in the matter."

CENTREVILLE, MD.—Our correspondent here sends us the following communication: "A bill has passed both Houses of the Maryland Legislature empowering the people to vote on the question whether the Town Commissioners shall issue bonds to the amount of \$20,000 for the construction of water-works. The bill has not yet been signed by the Governor, but there is no doubt but what it will. The election will take place April 2, when three new commissioners will be elected."

STONINGTON, CONN.—The people of this place decided, at a recent meeting, to accept the offer made by the Mystic Valley Water Company to supply the place with water for fire protection and private use. The terms of the contract state that the company is to furnish the borough with a water service from forty-two hydrants, to be located under the direction of a committee representing the borough, said hydrants to be supplied from a reservoir to be constructed with a capacity of 2.000,000 gallons, the fall to be not less than to feet. Mains will also be laid throughout the different parts of the place, and families will be supplied from the same source. The construction of the system is to begin at once

COLUMBUS, O.—The bill authorizing the Governor to appoint a commission of five with power to provide Cincinnati with a new water-supply at a cost not exceeding six million dollars has been unanimously recommended for passage by the committee of the legislature to whom it was referred. If the recommendations of the expert commission, elsewhere reported in this issue, are carried out, a large sum for iron pipe will be expended.

GUVANDOTTE, W. Va.—Traverse E. Stout, attorneyat-law, sends the following communication concerning
the water-works project here: "In theimatter of the
water-works at this place I will say that the plant will
be built and operated in connection with the Huntingalready in successful operation. The total cost of the
two plants will be in the neighborhood of \$300.000.
The American Water-Works and Guarantee Company
will build the plant, being the same company that built
the plant in Huntington."

Cassopolis, Mich.—Concerning the reports that the water-works here were to be improved, we have received the following communication from William Jones, the village clerk: "There is no contemplated improvements this season that I am aware of; however, there is a new board of trustees just l-cted which may do something in that line, as there is need of it."

WATERLOO, N. Y.—Concerning a published report that water-works were to be established here, Ichn P. Walsh, the town clerk, writes us as follows: "We have water works in Waterloo; we have had them about two years."

years."

Hot Springs, Ark.—A. N. Sill, Superintendent of the water-works at this place, writes us as follows: "We are about to move our present pumping plant to a new building and water-supply about one and a half miles from the city to what is known as "Big Chalybeate Springs," and have contracted with the Knowles Steam-Pump Company for 1.500,000 gallon duplex compound condensing engines, boilers for the present plant, laying new mains, and other necessary improvements."

JACKSON, MISS.—It is reported that a water-works company has been organized here.

company has been organized here.

Bentonville, Ark.—Mayor W. S. Floyd, of this city, writes us, under date of March 16, as follows: "We are going to establish water-works in this city. We have a proposition pending before the Council, but it will not be accepted. When we can look further into the matter, and when we receive a proposition that the city can accept we will establish the same; and in all probability the city will build its own works if we can buy material and make a suitable contract for construction of the same."

Hugo, Kan.—Our correspondent writes as follows: "The water-works bonds carried on the 9th inst. for \$6,000. We have a committee Fast making examinations of the water-works systems now in use, and will take no action until their return."

SCHWENKSVILLE, PA.—We are in receipt of the following communication from Irvin H. Bardman, the Town Clerk of this place: "The only movement in regards to water-works was the tongue movement (talk)."

Dalton, Ga.—We have received the following communication from John Black, Esq., of the Water Committee, under date of March 15:
"We first complied with the act of our Legislature in regard to any city issuing bonds. We have plans and specifications made, and are now considering offers for the complete construction of our system, and we hope to close contract with some reliable concern so as work will be ein by first of May. Will hold matter open yet for thirty days and longer if we are not satisfied with any bids we may receive."

MYSTIC VALLEY, CONN.—The voters of the Mystic Valley Fire District decided at public meeting, held March 15, to contract with the Mystic Valley Water Company for forty-seven hydrants, located at convenient points in the village, at an annual rental of \$1,680. The other details of the contract are similar to the one made by the same company with the Borough of Stonington, Conn. S. H. Buckley is at the head of a committee appointed to look after the work of construction, which is to begin at once.

MILWAUKEE, WIS.—The sum of \$80,000 was appro-priated at the last meeting of the Common Council for the Milwaukee River flushing-tunnel.

New London, Wis.—C. F. Dickinson, the Town Clerk, explains the water-works project here as follows: "We have taken no decisive steps as yet regarding water-works; are merely considering the matter, and awaiting the action of Common Council."

PANA, ILL.—Our correspondent writes as follows concerning the water-works project here: "There has been no official action here in regard to water-works, but a great amount of talk is being had in regard to putting in a system."

GRAFTON, W. VA.—Concerning the water-works project here John J. Gilligan, the Town Clerk, sends us the following communication, dated March 21: "Plans and estimates have been made by direction of the Council, the intention being to submit the question to the people at a special election some time during the summer. There is more than a probability that the town will have water-works inside of a year."

PINEVILLE, Ky.—Concerning the water-works project here our corresponder writes as follows: "Application has been made to the Legislature now in session for a charter. It will probably be granted and company organized this spring."

MANKATO, MINN.—A proposition to issue \$20,0 bonds to extend water-mains and establish a pumpin station also will be submitted at the spring election.

ORLEANS, NEB-It is stated that the people of this place have selected April 3 to decide the question of a \$10,000 system of water-works at the polls.

MOUNDSVILLE, W. VA.—Reports say that a water-orks system is to be established here.

MONTROSE, COL.—Some time in April the people of this place will decide for or against a \$50,000 system of water-works.

LLANO, TEX.—Reports say that a system of water-rorks will be established here by Fort Worth capital-

STAUNTON, ILL.—A contract has been drawn up by the Water-Works Committee of the Village Board of Trustees with the owners of the water-works site, whereby the Board can go to work clearing the land and making other arrangements about building the water reservoir, which will be done in the near future.

CLEVELAND, TRNN.—Reports state that water-works re to be established here, and that details can be had

OLDTOWN, ME.—It is reported that this place is to have water-works and that A. O. Brown can furnish details.

Monmouth, Ill. —A system of water-works, to cost \$48,000, is to be erected here.

JACKSON, MISS.—Reports say that water-works will be established here.

WALLULAH, WASH. T.—It is reported that water-works will be established here.

PADUCAH, Ky.—The water-works company here has een incorporated.

HARRODSBURG, Ky.—The Harrodsburg Water Company has been incorporated.

PARIS, Ky.—The Paris Water Company has been incorporated.

CENTRAL CITY, Ky.—Water-works have been incorporated here.

Owatonna, Minn.—The city has voted to build water-works.

MASBURY PARK, N. J.—Our correspondent writes as follows: "The borough will make some extensions to its plant this spring."

NRW BEDFORD, MASS.—New water-mains, to cost \$20,000, will be added to the water-works system here.

GLOVESVILLE, N. Y.—Address the Water Commissioners for details of a water-works system for this place, to cost \$100,000.

CHADRON, NEB.—It is reported that the proposed water-works system for this place will include several

CAMDEN, ARK. - The Camden Water-Works Company has been incorporated with S. Q. Sevier as president.

TULLAHOMA, TENN.—George W. Davidson is interested in a proposed water-works system for this place.

ested in a proposed water-works system for this place.

CUBRO, TEX.—John O. French is at the head of a project to supply this place with water from Guadaloupe River.

WATER - WORKS. — See our Proposal Column for information regarding water-works and water-works supplies at the following places: Salisbury, Md., Yonkers, N.Y., Ottawa, Kan., Welland, Ont., Hoboken, N.J., Whitewater, Wis., Nebraska, Neb., Waterbury, Conn., Newport, Ky., San Buenaventura, Cal., Tecumsch, Neb., Jersey City, N. J., Greensburg, Ind., Dalton, Ga., Louisville, Ky.

BRIDGES.

INDIANAPOLIS, IND.—The Marion County Commissioners will erect a 175-foot iron bridge over the White River, near North Indianapolis, and ask for proposals for the work. See our proposal column for details.

DENVER, Col.—It is reported that this city will expend \$150,000 in building viaducts over the railroad tracks during the present season.

ST. PAUL, MINN.—The Committee on Streets has passed a resolution providing for the building of the Wabasha Street bridge, according to the City Engineer's plans, providing that some feasible plan could be derived for raising the necessary funds. The amount required to build the bridge according to the approved

BRIDGE PLANS.—Plans for three iron railroad bridges re wanted at Los Angeles, Cal., until April 3. Ade-ress John H. Quinton, Chief Engmeer, San Gabrie alley Rapid Transit Railway Co., 55 and 57 Baker

I.EBANON, CONN.—Press dispatches say that breaking of a dam here on the 20th inst, destroye bridges besides doing considerable other damage, dam was connected with the Exeter reservoir.

MILFORD, DEL.—It is reported that a large iron bridge is to be erected here, and that John D. Norris, of Georgeton, Pa., can furnish details.

HAMILTON, O.—The County Commissioners will place a bridge over the Miami River, to cost \$30,000

BRIDGES.—See our Proposal Column for information regarding bridge construction at the following places: Indianapolis, Ind.: Atchison, Kan.; Los Angeles, Cal.; Minneapolis, Minn.

RAILROADS, CANALS, ETC.

LITTLE ROCK, ARK.—The City Electric Street Railway Company has one mile of its line about completed and another well under way. Another mile and three-quarters will be let in a few days. The contract for the West Markham Telford Macadam district has been awarded to the Arkansas Industrial Company.

GRAND RAPIDS, MICH.—The Valley City Street and Cable Railway Company, of this city, has received a franchise allowing them the use of several miles of streets in which to construct and equip a cable or horse railway, a greater part of which will probably be a cable line. Address Valley City Street and Cable Railway Company, Grand Rapids, Michigan.

PINEVILLE, Ky.—Our correspondent writes; "A street railroad will be organized here, and built as soon as the charter passes through the Legislature."

Orange, N. J.—The tracks of the Orange and Newark Horse Car Company are to be extended to West Orange.

CAMBRIDGE, MASS.—The West End Street Railway omnany has decided to use the cable system and per-Company has decided to use the cable system and permission has already been granted from the Board of Aldermen for the construction of the road.

Owosso, Mich.—The city of Corunna, the township of Caledonia, and the Owosso Council have granted the right to the Port Huron Electric Railway and the Detroit Electrical Company jointly to construct an electric railway between the cities of Owosso and Corunna. According to the terms of the grant the work of building the road must be begun within 90 days

the work of building the road must be begun within 90 days.

Brockton, Mass.—The East Side Street Railway Co., of Brockton, has organized with a capital of \$45,000 and will build 4½ miles of road the coming season. It is probable that a careful investigation of horse power versus electric motor as a propelling force will be made. E. L. Brown has been appointed engineer to the corporation.

WASHINGTON, D. C.—The sum of \$17,500 has been appropriated for placing an electric-light plant in the north wing of the capitol.

Sloux City, Iowa.—Articles of incorporation are to be filed here for an elevated railroad, with a cash capital of \$1,000,000. A. S. Garretson is one of the incorporators.

GAS AND ELECTRIC-LIGHTING.

WAHPETON, DAK.—H. W. Turner, of St. Paul, has been granted twenty-one years' franchise to light the city with electricity. He will furnish ten 200-candle lights at \$1,800 a year.

CONWAY, ARK.—It is reported that an electric-light plant will be established here.

CANANDAIGUA, N. Y.—The Canandaigua Electric-Light Company has been incorporated; capital, \$50.-000. Alexander Grieve and others, incorporators.

EUREKA, KAN.—The Eureka Electric-Light and Power Company has been incorporated; capital, \$25,000. A. S. Van de Mark and others, incorpo-

Winchester, Tenn.—It is reported that an Edison electric-lighting plant is to be established here, with a capacity of 200 lights, and that Girton & Smith can furnish details.

JACKSON, MISS.—Reports say that an electric-light ompany has been organized here.

CLEVELAND, TENN.—It is reported that J. H. Craic-niles can furnish details of a project for gas-works

TERRELL, TEX.—According to reports an electric-light plant is to be established here, with Mr. Cook at

JACKSON, MISS.—It is stated that an electric-light plant will be established here. The Board of Trade is said to be in charge.

SHELBYVILLE, TENN.—It is stated that an incandescent plant is to be added to the arc system here.

ASHTON, DAK.—The Ashton Gas and Fuel Company will incorporate. Capital stock, \$100,000. The company will work the natural gas well here.

MASON, MICH.—The question of establishing an electric-light plant is again being agitated here.

WEST NEWTON, PA .- A new gas company has been organized here and will establish works at once.

Orange, Mass.—It is reported that this place has appropriated \$1,500 for an electric-lighting system.

BROOKLYN, N. Y.—Another application has been made to the Aldermen by the Edison Electric Illuminating Company to lay its conduits and wires in the streets. It was referred to the Lamps and Gas Committee.

THE Georgia Portable Water-Gas Company, A Ga. Capital, \$20,000. W. S. Crane, and othe corporators.

ROCHESTER, MINN.—The Rochester Light and Fuel Company has been incorporated; capital stock, \$100,-000; incorporators, F. F. Walker, of Dubuque, Iowa; Thomas Hennessey and William O'Mulcahy, of Grand Forks, Dak.

RICHMOND, VA.—The Virginia Electric Light and ower Co., of this city, will put in an additional

DAVENPORT, Ky.—The People's Light Company has een incorporated here.

KEY WEST, FLA.-This place is to be lighted by electricity.

BIDS OPENED.

Grand Rapids, Mich.—The following bids for pump for water department were received by Board of Public Works, March 17: Eagle Iron Works, Detroit, Mich., \$5.584.75; Butterworth & Lowe, Grand Rapids, \$8,447; Adolph Leitelt, Grand Rapids, \$0,185. The contract was awarded to the Eagle Iron Works.

Tract was awarded to the Eagle Iron Works.

MINNEAPOLIS, MINN.—Bids for the substructure of the \$40,000 Lyndale Avenue Bridge have been opened as follows: Baxter & Sons, \$6,708.07; Minnesota Stone Company, \$6,185.65; M. Daley, \$6,868.68; George McMullen, \$6,596.10; Ring & Tobin, \$7,870.34; Douglas & Co., \$6,504.22.

Bids on the superstructure were: Canton Wrought-Iron Bridge Company, \$20,635; Canton Wrought-Iron Bridge Company, \$20,635; Canton Wrought-Iron Bridge Company, \$20,83; King Bridge Company, Cleveland, \$20,303; A. G. Bayne & Co., \$4.056; Scheffler Bridge Company, Milwaukee \$23,070.24; Kansas City Bridge Company, \$23,750; Smith Bridge Company, Toledo, \$21,000; Jones Bridge Company, Chicago, \$21,536.23.

MILWAUKER, WIS.—The following hids for furnish.

MILWAUKEE, WIS.—The following bids for furnishing a water-gate for the Milwaukee River flushing tunnel were opened March 16: Edward P. Allis & Co., \$1,625; Gardiner Campbell & Son, \$1,450.

Stock; Gardiner Campbell & Son, \$1,450.

COLUMBIA, O.—The following bids for brick and cement were opened by the State House Commission, March 16: Cement, per barrel—Fleming & Devereaux, Charleston, \$1.68; C. O. Brown & Bro., Columbia, \$1.78; Lorick & Lowrance, Columbia, \$7.85; J. M. Mayhew, Columbia, \$2. Brick, per 1,000—C. A. Guignard, Lexington, \$10, delivered by April 15; T. W. Stanland, Summerville, \$10. The contract for furnishing the cement was awarded to Lorick & Lowrance, and the brick contract to T. W. Stanland.

NEW YORK CITY.—The following was the only bid submitted for furnishing a steam-elevator at the Charity Hospital, at Blackwell's Island, opened March 16 by the Department of Charities and Correction: Joseph Moore, New York, \$2,825.

Minneapolis, Minn.—The Committee on Roads and Bridges has awarded the contract for the superstructure of the new bridge over the railroad tracks on Lyndale Avenue to the Canton Wrought Iron Bridge Co. at \$79,575. The substructure work was awarded to the Minnesota Stone Co. at \$6,799.75.

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New York Cive.—Bids were opened by the Department of Docks, March 12, as follows: For turnshing 856 pieces of granite for bulkhead or river wall, consisting of 201 headers and 465 stretchers, containing about 18,200 cubic feet in all. The b ds were: Guidet & Co., \$1.45 per cubic foot; J. Goss, Jr., \$1.03 per cubic foot.

ST. Louis, Mo.—The following b.ds were opened by lenry Flad, President of the Board of Public Improvements, March 13:

For furnishing 670 tons of 36-inch cast iron wasteipe, A, B, and C—Addyston Pipe and Steel Co., \$19,30; Dennis Long & Co., \$19,262.50; Shickle, Harrison: Howard Iron Co., \$17,051.50; R. D. Wood & Co., 20.066.50.

\$20.066.50.

For 35 tons of special castings—Addvston Pipe and Steel Co., \$2,635; Dennis Long & Co., \$2,555; St. Louis Iron and Machine Co., \$7,380; Schickle, Harrison & Howard Iron Co., \$2,026.50; R. D. Wood & Co.,

son & Howard Iron Co., was the St. Louis Iron and For one 36-inch check-valve—St. Louis Iron and Machine Works, \$1,038.90; Fulton Iron Works, \$1,245.

For one 36-inch check-valve—St. Louis Iron and Machine Works, \$1,036.90; Fulton Iron Works, \$1,245.

Bufffalo.N.Y.—The following bids for pipe, valves, pavi.g., and other materials were opened March 20 by the Water Commissioners:

Cast-iron ppe and special castings: Donaldson & Duncan, Lake Shore Foundry, Detrcit Pipe and Foundry Co., Addyston Pipe and Sieel Co., Shickle, Harrison & Howard Iron Co., &t. Louis, Mo., submitted bids which were declared informal as they furnished no bonds; Warner, Wood & Co., 4 inch, \$2,05.6 inch, \$30.95; Mellert Foundry and Machine Co., Phillipsburg, Pa., 4 inch, \$2,24.6 inch, \$28.60, to inch, \$28.20, io inch, \$28.20, io inch, \$28.20, io inch, \$28.20, io inch, \$27.80, io ii ch, \$27.90, 20 inch, \$27.80, io ii ch, \$27.90, 20 inch, \$28.20, io inch, \$28.20 io ii ch, \$27.90, 20 inch, \$27.80, io ii ch, \$27.90, 20 inch, \$27.80, io ii ch, \$27.90, 20 inch, \$27.80, io ii ch, \$27.90, 20 inch, \$27.80, io ii ch, \$27.90, 20 inch, \$28.20 for all siz; s. stipulating to deliver on streets where wanted. In consideration of the cost of transportation from cars, estimated at \$1 per ton, the bid of the Buffalo Company was accepted.

Valves: I. S. Carson & Co., Philadelphia, Pa., informal; Eddy Valve Co., Waterford, N. Y., 4 inch, \$8,6 inch, \$35.50, 24 inch, \$550, 24 inch, \$80, 20 inch, \$10, 26 inch, \$550, 24 inch, \$10, 26 inch, \$550, 24 inch, \$10, 26 inch, \$550, 24 inch, \$10, 10, 26 inch, \$500, 20 inch, \$110, 26 inch, \$500, 24 inch, \$110, 26 inch, \$500, 20 inch, \$110, 26 inch, \$500, 20 inch, \$110, 26 inch, \$500, 20 inch, \$110, 26 inch, \$600, 20 inch, \$110, 26 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20 inch, \$110, 20

Boston, informal. The contract was awarded to the Ludlow Co.

Corporation taps—Fries & Co., Buffalo, ½ inch, 60c.; ¾ inch, 70c.; ¾ inch, \$5t.; 1 inch, \$1. is. Hardwicke & Ware. ½ inch, 65c.; ¾ inch, 95c.; 1 inch, \$1.50. Collignon & Grimard ½ inch, 45c.; ¾ inch, 70c.; ½ inch, \$1.1c.; 1 inch, \$1.30. The contract for valves and service boxes was awarded to Bingham & Taylor Buffalo.

Hydrants—R. D. Wood & Co., Philadelphia, \$47 on cais; Buffalo Forge Co., \$33 delivered; Howard Iron Works, \$31.50 delivered; Ludlow Valve Manufacturing Co., \$33.34 on cars. Contract awarded to the Howard Iron Works.

For tile the contract was divided between the Buffalo Sewer Pipe Company and John Lyth & Sons at 55 per cent. off list prices.

TOLKDO, O.—The following bids for furnishing a new pumping-engine and also for the purchase of the work workington engines now in use were opened by new pumping-engine and also for the purchase of the two Worthington engines now in use were opened by the Water-Works Trustees March 15: Holly Manufacturing Co., rotary horizontal, \$49,500; will allow \$7.500 for Worthington pumps; also, another engines, \$42,000; allowance for Worthington engines, \$7,500; also, triple expansion, \$55,000; allowance, \$7,500. George S. Blake Manufacturing Co.: Direct action horizontal engine, \$34,975; no bid for old engines. Henry R. Worthington: Direct horizontal, \$43,600; allowance, \$2,000; also, direct vertical engine, \$49,750; allowance, \$2,000. Knowles Steam-Pump Co., direct horizontal, \$45,000; allowance for Worthington engines, \$10,000. The board took no action on these bids.

New York Ciry.—The following bids for 'removing the old pier and dumping board and for building a new wooden pier at the foot of Forty sixth Street, East River, and for repairing the crib builkhead thereat, were opened by the Department of Docks March 16: John W. Flaherty, \$18,548; Joseph Waish, \$10,-816; John D. Waish, \$17,874; O'Connell & Coffey, \$17,752.50; J. H. Staats, \$18,030.

KALAMAZOO, MICH.—The following bids for iron superstructure for bridge over the Kalamazoo Rive were received by Chauncey Strong, City Cierk, March

were received by Chauncey Strong, City Ciera, marcia 20:

Wrought Iron Bridge Co., Canton, O., \$14.100; Pittsburg Bridge Co., Pittsburg, Pa., \$14,500; Massillon Bridge Co., Massillon, O., \$14,600; Smith Bridge Co., Toledo, O., \$14,500; King Iron Bridge Co., Cleveland, O., \$14,60; P. E. Lane, Chicago, Ill., \$14,800; Penn Bridge Co., Beaver Falls, Pa., \$14,875; Mt. Vernon Bridge Co., Mt. Vernon, O., \$14,925; Columbus Bridge Co., Columbus O., \$14,000; Milwaukee Bridge and Iron Works, Milwaukee, Wis., \$15,000; Indiana Bridge Co., Muncie, Ind., \$15,300; Variety Iron Works Co., Plan "A." \$15,600; Plan "B." \$15,825.

Hannad O.—No hids were received by Obed Horry

UBBANA, O.—No bids were received by Obed Horrs City Clerk, for lighting the public streets, etc., up to March 17, the date advertised for opening.

GOVERNMENT WORK.

LEXINGTON, Kv.—The following bids for labor and plumbing and gas-fitting in the post-office were opened March 14 by the Sepervising Architect of the Treasury Department: McElhine & Moleney, 48,861; Lexington Plumbing Co., \$2,081.00; Crook, Homer & Co., \$2,000.

ST. JOSEPH. Mo.—The following bids for taking down and rebut ding certain work on the post office were opened March 15 by the Supervising Architect of the Treasury Department.

McCarthy & Baldwin, \$37.520; Pfeiffer, Stone & Co., \$39,685; Rice & Bassett, \$37.434.

\$39,685; Rice & Bassett, \$37,434.

Columbus, O.—The following bids for labor and material for painting the walls, ceilings, and iron stairs of the Court-House were opened, March 13, by the Supervising Architect of the Treasury Department. The bids for doing the work according to specifications were as follows: Fisher & Jenson, \$4,555; O. J. Kover & Son, \$2,248; Rohleitter & Woolfle, \$4,170,82. For doing the work with three coats of paint of the saine shade, Fisher & Jenson, \$2,284; O. J. Kover & Son, \$1,730,50. Fisher & Jenson also submitted the following bids: for doing the work with three coats, the same shade, ornamental, \$2,985; with three coats of paint same shade, distemper colors, \$2,822.

New Albany, N. Y.—The following bids for interior finish, including furring, lathing, plastering, ioining, wood floors and stairs, marble work, glass, hardware, painting and polishing for the court house were opened March 19 by the Supirvising Architect of the Treasury Department: Hoover & Christian, Chicago, Ill., \$18,373; acd tional floor, per souare foot, 8 cents; additional for oak P. O. screen and stairs, \$168; Mc-Carty & Baldwin, Washington, D. C., \$18,710; additional floor, per square foot, 12 cents; oak, \$700; James H. Coster, Baltimore, Md., \$24,000; additional floor, 10 cents; oak, \$1 500; Davidson & Son, Chicago, Ill., \$25,436; additional floor, 14 cents; oak, \$400; J. W. & F. G. Robinson, Cincinnati, O., \$21,299; additional floor, 5 cents; oak, \$900; Jungelaus & Schumacher, Indianapous, Ind., \$10 883; additional floor, 6 cents; oak, \$400; Geo. W. Corbett, Washington, D. C., \$10,300; floor, 9 cents; lohn Mitchell, I ouisville, Ky., \$18,830; deduct \$200 if cypress is used; additional floor, 12½ cents; oak, \$300; Robert Mitchell Furring Co., Cincinnati, O., \$25,781.45; additional floor, 12½ cents; oak, \$960.

Baitimore, Md.—The following bids for extra

BAITIMORE, MD.—The following bids for extra marble tiling, wainscoting and door sills, under original specifications, dated September 8, 1886, were opened March 16 by the Supervising Architect of the Treasury Department: Fishbach Eros., Baltimore, Md., \$4,833.67; Davidson & Sons, Chicago, Ill., \$5,233.12; F. W. Smith, \$4,244; Riddle & Williams, Baltimore, Md., \$3,300; Sherman & Flavin, Chicago, \$5,980.

NEW CORPORATIONS.

THE Des Moines and Kansas City Railway Company, Des Moines, Iowa. Capital, \$10,000,000. R. F. Wilson, and others, incorporators.

THE Central Metropolitan Subway Company, Chicago, Ill. Capitai, \$100,000. A. C. Schmeltz, and others, incorporators.

MISCELLANEOUS.

NEW YORK CITY.—The commuter of the Board of Aldermen, to which was referred the resolution compelling owners of property on the Hailem waterfront to fill in their lands, has reported against the passage of the ordinance, affirming that it would work injustice to individuals. It reported at the same time in favor of requesting Congress to appropriate at once the sum of \$2,300.000 for the completion of the improvement of Harlem River and Spuyten Duyvil Creek in accordance with the plans already approved by the War Department.

REIDSVILLE, N. C.—The people of this place will hold n election. April 10 to settle the question of bonding he village in the sum of \$75,000 for public improve-

ROANORE, VA.—It is reported that this city has voted of issue bonds in the sum of \$60,000 to erect school utildings, construct sewers and make other improve-

ments.

Ming rapolis.—The following is a list of the large full buildings now under construction or soon to be begun in this city: Court House, \$1.150,000; Guarantee Loan and Trust Co., \$0.000; Pionaldson's building, \$150,000; Brackett building, \$150,000; Brackett building, \$150,000; Wright building, \$10,000; Lumber Excharge, \$200,000; Wright building, \$10,000; Lumber Excharge, \$200,000; Minghapolis pumpit g-station, \$214,000; Crowell building, \$35,000; Anderson huilding, \$15,000; Dahl building, \$20,000; Spectator building, \$15,000; Dahl building, \$20,000; Blo mington Avenue Church, \$15,000; William Eerg building, \$15,000; J. F. Collom building, \$20.000; Webster & Hoit, \$22,000; C. S. Biackett & Co., \$10,000; J. W. Shadewell, \$10,000; J. F. Record, \$10,000; A. B. Latham, \$10,000; total, \$3,330,000.

PROPOSALS.

(Continued from page viii.)

IRON BRIDGE SUPERSTRUCTURE.— Proposals are wanted at Indianapol s. Ind., until April 12, for iron superstructure for bridge over the Wnite River, near North Indianapolis; superstructure to be in two spans of 130 feet each in the clear, with an 18-foot clear readway; total length of the bridge from face to face of the abutments to be 355 feet. Bidders to furnish their own plans and specifications therefor, and complete strain sheet to accompany each plan. Address Thomas Taggart, Auditor, Marion County Commissioners, as above.

SIDEWALKS.—Proposals are wanted at St. Paul, Minn., until Maich 29, for onstructing sidewalks in certain streets. Address W. F. Erwin, Clerk Board of Public Works.

BUILDING ADDITION. - Proposals are wanted at New York City, until March 31, for building additions to pavilions, B. C and D, and dinning room and kitchen A, at Central Islip. L. I. Address the Department of Charities and Corrections, No. 66 Third

WATER SUPPLY.—Proposals are wanted at Jer sey City, N. J., untu April 2, for furnishing a pure and wholesome supply of water to Jersey City, proposals to be based on their own specifications. Address Martin Finck, C. erk, Board of Public Works.

STREET LIGHTING.—Proposals are wanted at Newport, R. I., until April 2, for lighting the public streets, etc., with electricity, gas or raphtha. Address William O. Greene, Chairman, Committee on Street

DREDGING .- Proposals are wanted at Philadelphia, Pa., until April 2, for dredging d.ck on the Delaware and Schuylkill Rivers, not belonging to the city, into which city sewers empty. Address George A. Cotton, President Board of Wardens.

FLAGGING.—Proposals are wanted at Brooklyn, N. Y., until April 2, for flagging certain streets. Address John P. Adams, Commissioner of the Department of City Works.

BRIDGES, - Proposals are wanted at Atchison, Kan, until April 11, for repairing three non bridges. Address Fred. Giddings, County Engineer.

STFAM-HEATING .- Proposals are wanted at St. Joseph, Mo., until May 14, for a system of heating the County Court House with stram, hot water, or hot air. Address the County Court of Buchanan County, as above.

PROPOSALS.

VENTILATING GRATES.—Proposals are wanted at St. Paul, Minn, until May 1, for about 90 ventilating grates for the Ramsey County Court House. Address M. F. Kain, Secretary Court House and City Hall Special Commissioners, as above.

LIFF-SAVING STATION.—Prope sals are wanted at Washington, D. C., until March 28, for the construction of a life-saving station on Napeague Beach, about five miles east of Amagansett, L. I. Address S. J. Kimball, General Superintendent, U. S. Life-Saving Service, as above.

BUILDING. - Proposals are wanted at Far-bault Minn., until April 9, for constructing a new building for the Feeble-Minded Department of the Minnesota Institute for Defictives according to plans and spicifications. Address H. E. Barron, Superintendent of Construction, as above.

ELEVA FORS.—Proposals are wanted at St. Paul, Minn., until May 1, for furnishing, etc., two elevators for the Ramsey County Court-House and City Hall. Address M. F. Kain, Secretary Court-House and City Hall Special Commissioners, as above.

IRON TRESTLE WORK.—Proposals are wanted at Los Angeles. Cal. until April 3, for the construction of 8co feet of iron-trestle work. Address John H. Quinton. Chief Engineer, San Gabriel Valley Rapid Transit Railroad Co., Nos. 55 and 57 Baker Elock, as

IRON BRIDGES.—Proposals are wanted at Los Angeles, Cal., until April 3, for the construction of three iron bridges. Address John H. Quinton, Chief Engineer, San Gabriel Valley Rapid Transit Railway Co., 56 and 57 Baker Block, as above.

ELECTRIC LIGHTING.-Proposals are wanted at St. Joseph, Mo., until May 14, for a system of in-candescent lighting, giving 200 lamps of 16-candle power each; also a high speed engine, boiler, heater, feed pump and fixtures complete. Address the County Court of Buchanan County, as above.

WATER-WORKS. — Proposals are wanted at Greensbury, Ind., until April 18, for the construction of a water-works system under a franchise to be granted by the city. Address Mayor A. S. Creath.

STONE ABUTMENTS.—Proposals are wanted at Minneapolis, Minn., until March 28, for building stone abutments for the proposed bridge over Bassett's Creek. Address Andrew Rinker, City Engineer.

RESERVOIRS.—Proposals are wanted at Albany, N. V., until March 29, for building the reservoirs at Tivols Lake, Patroon's Creek and Sand Creek, and for laying the distributing and connecting pipe lines, Address the Secretary of the Special Water Commission, 25 North Pearl Street, Room 18, as above.

BUILDINGS.-Proposals for the erection of certain buildings for the Ohio Societes' and Sailors' Home will be received at the office of the Board of Trustees of the said Home, in Sandusky, O., until April 20. Address R. B. Brown, Secretary.

SCHOOL.—Proposals are wanted at Duluth, Minn., until April 6. for the erection of a brick school. Address George Kupley, Clerk Board of Education.

BUILDING IFR.—Proposals are wanted at New York City until March 28, for estimates for removing all that part of the old pier at the foot of Fifty-first Street, North River, which lies westerly of a line 50 feet west of the new bulkhead-line, and preparing for and bulding a new wooden pier. Address the Department of Docks.

COURT-HOUSE.—Proposals are wanted at Ellisville, Miss., until April 2, for the construction court house. Address the Board of Supervisors.

TRAP BLOCK AND GRANITE PAVING.— Proposals are wanted at New York City, until March 28, for paving with trap block and granite. Address the Department of Public Works.

WATER-WORKS.—Proposals are wanted at Dal-ton. Ga., until about April to, for the construction of a complete system of water-works, according to speci-fications. Address John Black of the Water Com-

SEWER PIPE, ETC.—Proposals are wanted at Louisville, Ky., until Atril 2, for sewer pipe, plumbing, and water service, including pumps, for the West Tennessee Hospital at Bolivar. Address McDonald Bros, as above.

RAILROAD,-Proposals are wanted at Decatur, RAILNOAD,—Proposals are wanted at Decatur, Ala., no date specified, for constructing, etc., a street railway, in which the following labor, etc., is included: Excavating, etc., 3,900 cubic yar's of dirt. For 6,000 sawed oak ties, 72 tons of 16-pound steel rail, 5,000 pounds spikes, 1,000 pounds spike bars, also laying track and surfacing. Address W. E. Ferest, Decatur, and Moulton Heights Street Railway Company, as above.

BRIDGE FOUNDATIONS.—Proposals are wanted at Indianapolis, Ind., u.t.il April 12, for excavations, timber for the foundations of the pier and abutments and masonry of the pier and abutments for a bridge over White River, near North Indianapolis. Address Thomas Tagaart, Auditor, Commissioner of Marion County, as above.

BUILDING.—Proposals are wanted at St. Cloud, Minn., until April 3, for erecting the Minnesosa State Reformatory. Address D E. Myers, Superintendent of the Reformatory.

PAVING, ETC.--Proposals are wanted at Portsmouth, Va.. until March 22, for 1 200,000 paving bricks, 22,000 lineal feet curbing, 18,000 lineal feet gutter stone, 4 000 feet flagstone, 1,004 feet 12-inch vitrified drain pipe with rings, 1,140 feet 24-inch vitrified drain pipe with rings, etc. Address John H. Hume, as above.

VAULT DOORS.—Proposals are wanted at St. Paul, Minn. until May 1, for furnishing about thirty-two vault doors and window shutters for the Ramsey County Court House. Address M. F. Kain, Secretary Court and City Hall Special Commissioners, as above.

FIRE HOSE.—Proposals are wanted at !filwaukee, Wis., until April 2, for 5,000 feet of hose for the Fire Department. Address the City Clerk.

Building Intelligence

WE solicit from each and every one of our readen also matton relating to projected buildings in the cality, and should be glad to receive mergar clippings and other items of interest.

ABBREVIATIONS.—A s, brown stone; br, bnck; br a brick store; As dwell, brown stone dwelling; symbols, apa, apa, and brick store; est, tenement; c. see

NEW YORK.

N s 52d st, 75 w oth av, br stables; cost, \$7,000, eter Stewart; a, Audrew Spence. Es Morris av, 226 n 139th st, 4 br tenes; cost, \$40.00 all; o, Jos Hewlitt; a, A B Ogden & Sons 553 E 135th et, br ten; cost, \$12,000; 0, Edward Fr. gins; a, John B Snook & Sons.

5 and 7 Broadway, br office; cost, \$10,000; 0,57 Meyer; a, Samuel T McKewn.

Secor rarst st and 7th av, 4 br flats; cost, \$7.20 all; o Henry T McGuckin; a, John H friend. 76 W 124th st, br flats; cost, \$24,000; o, Wmand line Young: a, Geo W Hughes.

N s 142d st, 100 e College av, 4 fr dws; cost, \$11:00 l; o, Henry G Cooper; a, Robt E Rogers.

493-95 oth av, 2 br flats; cost, \$36,000 all; 0, May ! McGlynn; a, Jos M Dunn. 497 oth av, br flats; cost, \$10,000; o and a, single above.

Es Avenue A, cor 83d st, br flats; cost, \$10,000; Fred Braender; a, Edward Wenz.

E s Avenue A, 27 s 83d st, 3 br flats; cost, \$45.00210 o and a, same as above. Es Avenue A, 102 s 83d st, br tens; cost, \$12,200 o and a, same as above.

N s 107th st, 72 w 1st av, br factory; cost, \$11,000: John C illen; a, C C Buck.

N s Grove st, 125 w Bleecker, 3 brflats; cost, \$1500. all; o, Jas Kyle; a, F T Camp. 408 W 19th st, br flats; cost, \$16,000; 0, Samuel ii Havens; a, Ralph S Townsend.

N s 95th st, 350 e 1st av. 2 br flats; cost, \$37,002 o, John Brown; a, Burger & Baylies.

151 W 81st st, br dw; cost, \$20,000; o, Carit L &c. nedy; a, David Burges.

S w cor rooth st and 4th av, br flat; cost, \$25,000 a. Wm Fernschild & Son.

Es 1st av, nr 73d st. 4 br trns; cost, \$28,000 al; 5. Jos Butterweider; a, Geo B Pelham,

N w cor Madison and Pike sts, br dw; cost, \$7,000 o, Katherine Lochman; a, Schneider & Heiter. Ne cor 82d st and 3d av, 2 br dw and stores CM, 70,000 all: 0, F W Mertins; a, Edward Wen.

S s 135th at, 185 w 5th av, 4 br dws; cost, \$4,000 at.

N s 78th st, 144 w Avenue A, br ten; cost, \$15 xx; h Thos Riley; a, R M Hunt. 170 Rivington st, br flat with stores; cost, \$3,500.50 Fay & Stacom; a, Rentz & Lange.

N = 52d st, 75 w roth av, 2 br flats; cost, \$50,0001, o, Elsworth L Striker; a, 6 B Pelham.

S s 83d st, 123 e Avenue A, 6 br and b s fats of. \$16,000 each; o, Thomas Smith; a, A B Ogden & St. S s 93d st. 85 w 1st av, br flat; cost, \$17,000; 0, Har7 Muidoon; a, G B Pelham. S w cor oad at and 1st av. 4 br flats; cost, \$2.001

(New York buildings continued on page xvi).

BROOK LVN

S & Ellery st. 100 w Marcy av, 3 fr dws; cost, \$25.500 all; o, Geo Straub; a, David Acter & Son. W s Tompkins av, near Park av, fr dw; cost, \$7.00' o, Lewis Carrow; a, same as above.

Bway and Halsey, brick dw; cost, \$10,500; 0, Heart Menken; a, Wm Field & Sons. 435 Bedford av. br dw and store; cost, \$10,000; 5, Mrs M T Radford; a, Fred Holmberg.

4 on Stuyvesant av near Bway, 7 on Quincy 224 Stuyvesant, 17 br dws; cost, \$50,000 all; 0 and a jab: McDicken.

N s Grove, 230 e Bway. 4 br dwell; cost, \$5,000 all o, Chas M Kuch; John Platte.

Se cor Van Cott av and North Henry st, 2 ir der. cost, \$8,000 ali; o, John Reilly; a, I D Reynolds. S s Jefferson av. 300 w Throop av, 2 brick dws; 654, 4.000 all; o, Wm Reynolds; a, same as above.

Sw cor Bushwick pl and Mourose av, it du 1:1 store; cost, \$7,000; o, George Lindsley; a, Th East-hardt.

MISCELLANEOUS.

ST. PAUL, MINN.—Dayton av, nr Farringtor II.
3-story stone dwell; cost, \$25,000; 0, A W Kreb
The Clinton Avenue M E Church will error 1
\$25 coo bidg

DUBUQUE, IOWA,—The sale of the Julien Hear of this city has been made the purchasers berg f D Stout, B E Linehan, and George B Burd. the consideration was \$70,000. A new hotel costing order consideration was \$70,000. A new \$500,000 will be built in its stead

WASHINGTON, D. C.—1425 G st, 4-story br bldi. cost, \$18,000; o, CC Glover; a, J H Windum; R I Fleming.

1330-22-34 9th st. 3 3-story br bldgs; cost, \$18,000.4 F T Brown; a, N T Haller.

F 1 Brown; a, N T Hailer.

2614 to 2624 L, N W, a 3-story br bldgs; cost, \$1000; o, Ed Godfrey; a, Bingham & Lowe.

217 Pa av, 3-story br bldg; cost, \$7,800; o, J A
Repetti; a, Owen Donnelly.

506 to 524 D St, 2 2-story br bldgs; cost, \$15,000.5

and a, D B Groff.

1528 P st. 3-story br bldg; cost \$11,000; 0. A? Brown; a, T F Schneider. 36r permits less than \$7,000 in value.

DUBUQUE, IOWA.—Eighth and Pine, br pomping station; cost, \$20,000; o, Dubuque Water Company.

LITCHFIELD, CONN.—Architect Hill of Water-bury, has furnished plans for a court-house to be erected here.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE MASSACHUSETTS INVESTIGA-TIONS ON WATER-SUPPLY.

WE have several times called attention to the systematic investigations upon water-supplies and upon methods of dealing with town sewage to prevent pollution of streams which are being carried on under the direction of the State Board of Health of Massachusetts. The report which has just been issued by this board, under date of January, 1888, upon water-supply and sewerage, confirms the opinion we have expressed that this work will probably be of great interest and practical value. The second part of this report is that which gives the results of the examinations of the waters of the Taunton, Charles, Blackstone and Merrimack Rivers, for each of which tables are given showing for seven months the results of systematic analyses of 1,509 samples of their waters, together with studies of the physical peculiarities of and of the animal and vegetable organisms present in them.

The board is very properly cautious in drawing conclusions from these tables, remarking that they cover only part of the year, and that, as the past summer was one of unusual rainfall, the waters of this period cannot be considered

The data of the tables relate to color, free ammonia, albuminoid ammonia, nitrogen as nitrates, turbidity, total solids, loss on ignition, fixed solids, and chlorine, and from these it is easy to trace, on broad lines, the progressive pollution of the stream upon which large towns are situated, the oxidation of the albuminoid ammonia into nitrates, and the effects of dilution by large tributaries. The importance of chlorine determination as evidence of sewage contamination is well shown by these tables.

The third part of the report relates to the purification of sewage by applying it to land, and more especially to the results obtained at the sewage experimental station at Lawrence. At this place a large number of experiments on the filtration of water and of sewage through various soils and combinations of soils have been made. For this purpose there were used ten circular tanks, each six feet deep, sixteen feet eight inches in diameter inside, and seventeen feet four inches at the top, sunk in the ground and under-drained into a section of a flume, where the effluent could be collected and examined. These tanks were filled to a depth of five feet with various materials-for example, in one was placed clean, white sand, in another peat, in a third garden loam, in a fourth clay and sand, etc. About two-thirds of an acre of filtering grounds were also used for the experiments upon sewage.

The results of these are very interesting, but cannot be summarized here, and every water engineer must consult the original tables. We can only say that the fine sand filter showed improvement in the filtered water the longer it was used. The final results with 1,000 gallons of the water supplied to the city of Lawrence flowing daily through the tank were complete removal of color, reduction of the organic matter to four-tenths, of the free ammonia to one-twelfth, of the albuminoid ammonia to one-sixth, and of the nitrates to three-quarters of the amounts in the applied water, while the chlorine remained unchanged.

This tank also gave a clear, colorless effluent with sewage applied at the rate of from 136 to

272 gallons per day, but the experiment had not continued long enough at the date of this report to permit of any definite conclusions.

While we think that the board underestimates the amount and precision of existing knowledge on this subject when they say that "at present no one can tell in regard to any area that may be selected the character of the effluent that will result from the application of sewage in large or small quantity, nor the effect of our winters, nor of long storms upon the efficiency of the bed, nor the proper intervals for application,' nevertheless true that the results of European experiments are not wholly applicable to our soils and climate; that there is need for careful trial and observation upon these points, and that the State Board of Health of Massachusetts is acting with its usual wisdom in attempting to make these trials.

The report of the engineer of the board refers mainly to filter-galleries for water-supply, and upon this we will comment hereafter.

THE COST OF MELTING SNOW.

AFTER the recent blizzard in New York and vicinity, Mayor Hewitt advised the use of steam to melt the obstructive snow-drifts, and many persons tried it with more or less success, running temporary pipes from their boilers into the snow-banks or into large boxes into which the snow was shovelled.

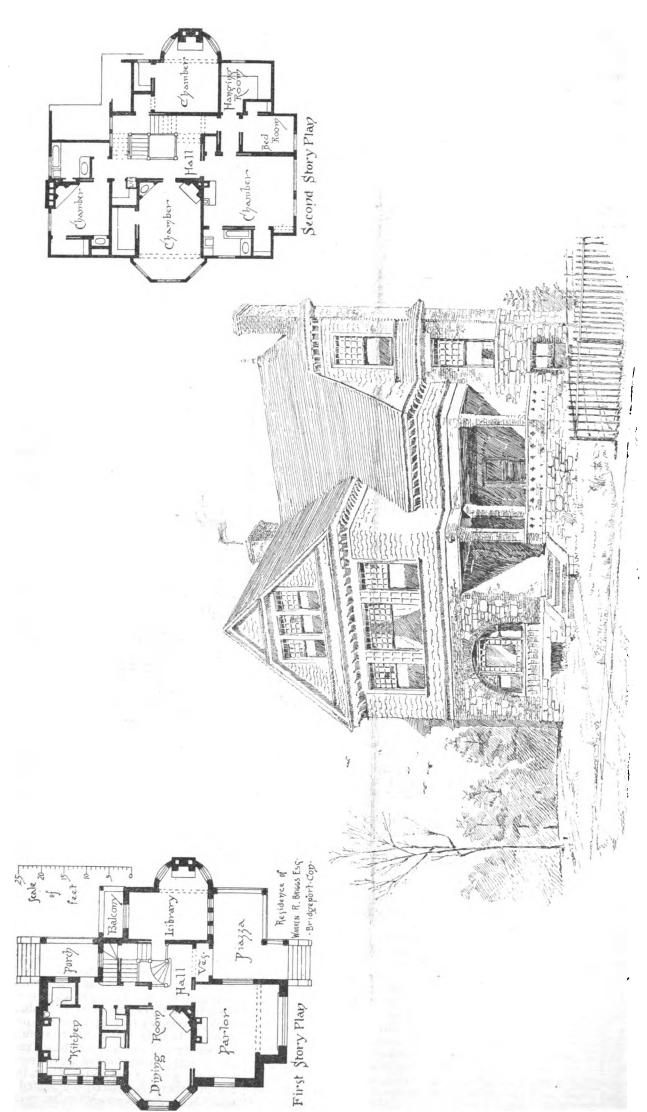
The emergency justified even such an expensive expedient, but lest any one should imagine that this method of removing snow should be generally adopted, we would remind them that to melt a pound of snow or ice takes as much heat as would raise the same weight of water from the ordinary temperature of 70 degrees to the boiling point.

Removing snow by melting in various ways has been frequently proposed, and in Volume IV. of this journal an apparatus was described, said to have been used in London, in which the snow was thrown down the sewer manholes, and there melted on iron plates kept hot by gas-jets. We then pointed out the impracticability of the plan, and Mr. E. S. Philbrick, M. Am. Soc. C. E., showed in our columns that to melt by gas the snow from a mile of ordinary street after a fall equal to three inches of rain, about equal to that of the blizzard, would require the consumption of about 100 tons of gas coal, provided all the heat was utilized; practically, it would take a great deal more. In another column we reprint the portion of Mr. Philbrick's communication referring to the consumption of fuel required.

A TEST OF SOIL RESISTANCE.

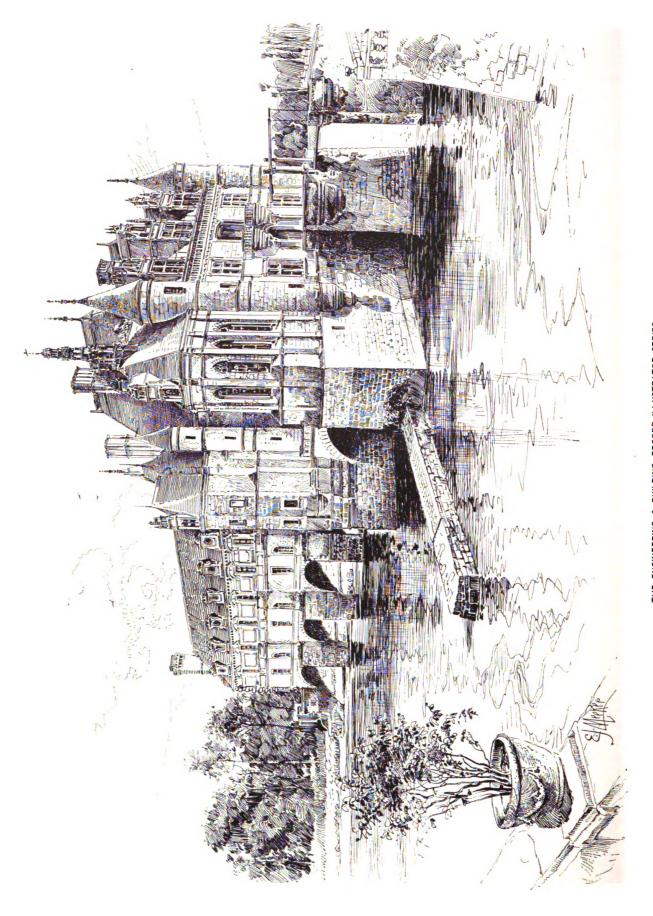
A NOTE in the Chronique Industrielle mentions some experiments that, though meagre, are interesting and would be more valuable if accompanied by any data concerning the condition and character of the soil. The experiments were made in the Champ-de-Mars to obtain the information necessary to proportion the foundations about to be built there. On a carefully leveled surface were placed four cast bases, each o.5om. (1.64 feet) square, located at the corners of a square of 3.5m. (11.48 feet). Upon these bases a T-iron frame was placed and loaded with iron bars. Settlement commenced after twelve hours, under a load of 64,074 kilos (141,282 pounds). The load was then gradually increased until it





RESIDENCE OF WARREN R. BRIGGS, ARCHITECT, BRIDGEPORT, CONN.

CHATEAU DE CHENONCEAUX, FRANCE.



reached 80,000 kilos (176,376 pounds) and was then left for the night. In the morning a settlement of 0.26 to 0.29m. (0.85 to 0.95 feet) was noted, and the load was increased to 93,400 kilos (205.947 pounds). The soil was considered capable of sustaining 60,000 kilos per square metre (12,288 pounds per square foot).

It would be well if similar experiments were made on the resistance of all soils on which it is proposed to place important buildings and the foundations designed in accordance with the results.

A record of such experiments and the settlement observed in the buildings after erection would soon become a very valuable guide in proportioning foundations about which there is usually an amount of guesswork that would not be tolerated in any other though much less important part of the structure, and that is certainly not creditable to engineering science or skill.

CHARLES LATIMER.

ALL who knew him will learn with sorrow that Charles Latimer died Sunday, the 25th inst., at his home in Cleveland, of apoplexy.

Mr. Latimer was a graduate of the U. S. Naval Academy at Annapolis, and was connected with the navy for thirteen years. In 1854 he entered an engineering party on the Mobile and Ohio Railroad, and was connected with that road till the outbreak of the war, during a part of which he was an engineer in the military service, returning to the Mobile and Ohio at the close of the war. After some experience on various roads he entered the service of the Atlantic and Great Western—now the New York, Pennsylvania and Ohio Railroad—in 1874, with which, as chief and consulting engineer, he was connected till the time of his death.

As the chief engineer of "a finished road," which during nearly all his connection with it was virtually bankrupt, Mr. Latimer had to struggle with a heavy traffic over an unballasted road, which at times could not even afford a fair complement of track hands; but he had so thoroughly imbued his men with the religion of track supervision that it is related that on the occasion of a reduction of both force and pay the men voluntarily worked overhours to keep the track in good repair.

Mr. Latimer brought to all problems great industry and a rare degree of religious enthusiasm. He believed he possessed the power of locating underground-water by the aid of a forked witch-hazel stick, and, it is said, was uniformly successful in his attempt to do so.

In addition to his conviction of the inconvenience of the metric units in practical use, and of the absurdity of English-speaking people, who expect their language to dominate the earth, adopting the measures of what he considered a decreasing and non-mechanical people, he had a firm conviction that the English inch was derived from and virtually identical with the unit of measurement employed in the construction of the great pyramid, to which he ascribed a Divine origin, associating at the same time infidelity of the French revolution with the metric section of measures.

Mr. Latimer was elected a member of the American seight of Civil Engineers in 1876, and was one of the nders and for some time president of the International stitute for the Preservation of Weights and Measures.

THE COST OF MELTING SNOW.

THE following is a portion of a communication dated ril 1, 1881, and received from Mr. E. S. Philbrick, M. em. Am. Soc. C. E., which we have referred to editorially.

After alluding to the various devices for melting snow artificial heat, he goes on to say:

Their absurdity becomes evident when we look into the ctual quantity of heat required, and the amount of fuel eeded to supply it. In the latitude of Boston, many 5 Towstorms bring an accession of snow equivalent to two three inches of rain. If we call it only two inches, the quantity falling on a single mile of street sixty feet in idth, besides what is brought from back yards and slides from roofs, would be 3,294,720 pounds, or over 1,600 tons. It is well known, though perhaps not so well appreciated by all your readers, that ice or snow cannot be melted without supplying to it 142° of heat, on Tahrenheit's scale; that is to say, as much heat as would be required to raise the same water after the thawing from

32° to 174°, or within 38° of the boiling point. This 142° of heat is absorbed by the water in the process of thawing, without any increase of its temperature, for the ice-water is just as cold, as shown by the thermometer, as the ice or snow itself. The only apparent effect of this accession of heat is in the fluid condition of the water, which before was solid.

It was proposed, in the article above referred to, to get rid of the snow in the streets by shoveling it into the sewer manholes, where it was to be thawed by gas-burners. Suppose a force of men and teams to be employed adequate to dump the 1,600 tons of snow per mile of streets into the manholes, how much gas would be required to thaw it by the heat evolved in its combustion?

The combustion of a cubic foot of street ordinary gas evolves about 760 heat-units. Although it is not practicable to utilize in melting the snow nearly all the heat so produced, a good deal of which will, in spite of us, escape into space, we will, for the sake of the argument, suppose it to be all saved and used. The snow from a mile of street would then require for its melting at least

$$\frac{3,294.720x142}{700} = 668,357$$

feet of gas. I will leave it for your readers to determine how many gas-burners, consuming four feet per hour each, would be needed to deliver and burn this amount within such a period as would be considered reasonable for removing the snow, and how many manholes of the ordinary size and style would be required within the mile to give room for these burners. The coal required to produce this quantity of gas is easily estimated. Modern gas-works turn out about 5 % feet per pound of coal, so that it would need about 64 tons of coal to thaw in this way the snow from a mile of length of street. Possibly the parties who devised this system would find themselves, before finishing the job, in a similar position to that described by Swift where the Lilliputians undertook to provide for the bodily wants of their visitor, Captain Gulliver. They would certainly find that gas is but a poor substitute for sunshine in more ways than one.

PROPOSAL OF PHILADELPHIA TO BUY GAS.

BOTH branches of the Philadelphia City Council have passed an ordinance authorizing and directing the Mayor of the city to advertise for proposals and enter into a contract for the furnishing by private parties of 3,000,000 cubic feet of illuminating gas each day. The gas to be manufactured at the works of the contractor, and furnished at the holders of the city for distribution through the city mains without any additional cost to the city than the contract bid, which is limited by the ordinance to be not more than fifty cents for 1,000 feet. The city to have the right to purchase plant and right to manufacture at any future period.

This ordinance is in consequence of the many complaints of the bad character of the gas turnished by the city works, and which was claimed by the Director of Public Works to be owing to the incapacity of the works to produce gas sufficient for the demand.

A PLAN TO UTILIZE NIAGARA'S POWER.

MR. WILLIAM GOLDING, a civil engineer of New Orleans, proposes the following plan to utilize in the city of Buffalo the power stored in the decending waters of the Niagara River, which has been estimated to be equal to 6,000,000 horse-power.

His plan is to run a tunnel from the Niagara River below the Falls to and along beneath the water front of Buffalo. This tunnel is to be of suitable inclination and dimensions to act as a tail race for any number of turbines or other water-motors which may be supplied directly from the waters of the lake.

The available head would be about 200 feet and the total length of the tunnel about 23 miles.

OBJECTION TO WATER-MOTORS IN ST. PAUL.

Some water-motors have for some time been in use in St. Paul, and, according to the *Pioneer Press* of that city, an effort has been made by certain people for their general introduction to operate elevators and other machinery, claiming that it is part of the business of the Water Department to furnish water for motive purposes and trying to influence the Chamber of Commerce to support their claims.

Mr. John Caulfield, Secretary of the Water Board, who has carefully studied the question, emphatically declared, when interviewed on the point, that under existing circumstances the general introduction of water-motors through the city would be detrimental to the service and in some respects dangerous, as the capacity of the water-works is not sufficient to supply any great number of motors and at the same time maintain the pressure needed

for efficient fire-service. He referred also to the experience of the Water Department of Rochester, N.Y., where, after a brief experience with water-motors, it was found necessary to prevent any more of them being used, as they made too great a draught on the limited water-supply to permit adequate service to the city.

"PURGING" PORTLAND CEMENT.

THE aqueduct to convey the waters of Vyrnwy Lake to Liverpool is a little over sixty-eight miles in length, consisting mainly of tunnels, through which a supply of 40,000,000 of gallons per day may be passed without filling them. A large part of the aqueduct has been completed, and nearly the whole can be finished by the autumn of this year. As so much has been heard of Portland cement failures during the past year, and as so much cement concrete, constructed under remarkably stringent supervision, and after searching tests, has been used in the Vyrnwy dam, it is worth noting that George F. Deacon, the Chief Engineer, is of opinion that these results would not occur with thoroughly purged cement. He says that, as is well known, fresh Portland cement is unfit for use. on account of the large quantity of uncombined lime it contains. If molded in this condition, the lime slakes while the cement is setting, and often breaks it up completely. To avoid this the cement must be thoroughly purged—that is, exposed to the atmosphere for a considerable time. By this means the lime is slaked to a sufficient extent to prevent any failure of the work from subsequent slaking. This action diminishes as the purging becomes more complete; but even in the best Portland cements after exposure to the air for an indefinite time, there is rarely a diminution, though there is sometimes an increase of strength if allowed to stand fifteen or twenty minute, between the process of mixing and placing in situ. In the opinion of the London Engineer it is difficult to ascribe any cause for this, except on the hypothesis that even in the best purged cement there remain minute points of compression, scattered throughout the mass, and produced by minute particles of lime which are slaked on the application of water. Whether or not this be the true explanation, the facts are indisputable, and have an important bearing upon many works in concrete. The methods of cooling or "purging" cement on the Vyrnwy works are new and efficient, and the thermometer is employed from time to time to detect any rise of temperature on the application of water to the cement. When this is systematically done no cement unsafe from the presence of free lime need be used. There is no doubt that the demand for a cement with high strength, and quick setting, has led manufacturers of Portland cement to over-lime them. Such cements are certainly not so safe to use, and it is a question whether ultimately they are as strong. The introduction of free lime in any quantity into Portland cement mortar at once reduces its strength to about that of ordinary cements, and highly-limed Portland cements are much more subject to what is called "blowing" after setting.

THE CALCULATION OF BRICK-WORK.

ORDINARY bricks are about 8 inches in length and, with the mortar joint, about half that in width, so that each brick on the flat will give a horizontal surface of about 32 square inches, or 41/2 bricks will cover a square foot. As ordinarily laid there are o courses to every 24 inches, or 41/2 to the foot. Four and a half courses with 41/2 bricks to the course gives 201/2 bricks to the cubic foot. Waste. cutting, and closer joints will easily require an allowance of 21 bricks per cubic foot, which will be found a very convenient figure for estimating the number of bricks required for a wall of a given size and thickness, as it thus becomes unnecessary to find the cubic contents of the wall. but merely to multiply its face area or the product of its length and height in feet by ? of its thickness in inches, which, as the thickness is always some multiple of 4 inches, is a very simple process.

For instance, a 20-inch wall 40 feet long by 30 feet high has a face area of 1,200 square feet, and as it is 5 times 4 inches in thickness it will require 5 times 7, or 35 bricks per square foot of face, or 42,000 bricks altogether.

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RESIDENCE OF WARREN R. BRIGGS, ARCHITECT, BRIDGEPORT, CONN.



EXCESS OF MATERIAL IN A WOODEN BRIDGE.

A STRIKING illustration of the excess of material used in many old timber structures, and the utter disregard of proportion displayed in their design, is seen in the case of a bridge over Black River, at Watertown, N. Y., which was built forty or fifty years ago and sustained the constant and increasing traffic of a large trading and manufacturing town until its recent removal.

The channel was divided by a centre pier into two 79-foot openings, over which the bridge was built in continuous spans of the Towne truss type, constructed throughout of 12-inch yellow pine plank 31/2 inches thick, connected with 2-inch oak pins at every intersection. There were six planks in each chord, and two in each of the diagonal members, which were three feet six inches c. to c. horizontally. There were two trusses fifteen feet six inches deep and eighteen feet apart, seated in the usual manner on timber sills on the pier and abutment masonry.

There was a double web system in each truss, and each chord was made in three parts of two planks each, the centre part being placed between the two web systems, outside of which again came the two other parts. In the cross-section, the web members are not shown in section, to avoid confusion on so small a scale. There are 8x8-inch diagonal braces in the planes of the top and bottom chords, and the structure, though unpainted, was covered by a roof not shown in the illustrations.

An unusually severe flood brought down heavy drift and damaged and finally destroyed the centre pier. Fortu-

would be less than 1,400 pounds per square inch, or about one-seventh of the breaking strain.

The strains in the web members are not so readily estimated and there is more uncertainty as to the value of their attachments, but there is evidently a much greater excess of material in them than there is in the chords. which, indeed, they must have considerably assisted, for it is obvious that the web system alone without any chords would much more than support itself.

No doubt this excessive amount of material was used ignorantly and as a matter of convenience, as ordinarily a 150-foot span without any centre pier would have been built with about the same quantity and arrangement of timber, and the bottom chord most likely wastefully spliced, but in any light, the fact that the clumsy old bridge safely did quadruple duty is very refreshing in these days when so many structures are so slenderly proportioned.

NEW LONDON SEWER ASSESSMENT DECISION.

THE important sewerage work recently executed at New London, Conn., by the Board of Sewer Commissioners, under the immediate charge of their engineer, Mr. W. H. Richards, with Mr. Rudolph Hering as Consulting Engineer, has been the occasion of some litigation on the part of those who objected to the assessments levied in connection therewith, and the decision just rendered by Chief Justice John D. Park and Judge Elisha Carpenter as arbitrators, confirming the assessments and vindicating the character of the work, will be of interest to our

objection. From the evidence before us, after having wit. nessed the practical operation of the sewer, we are satisfied that all sewage matter will be easily disposed of and with reasonable dispatch unless obstructed from other causes.

We come now to the specific objections stated in the appeal—reasons of appeal: (1.) That after the assessment were completed the board did not give reasonable notice to the appellants.

(2.) The second reason of appeal is: "Said board in assessing said alleged benefits are governed by a rule estab-lished by them of assessing benefits strictly and solely in proportion to the width and superficial area of the several lots fronting said sewer."

The rule adopted by the board, with the approval of the

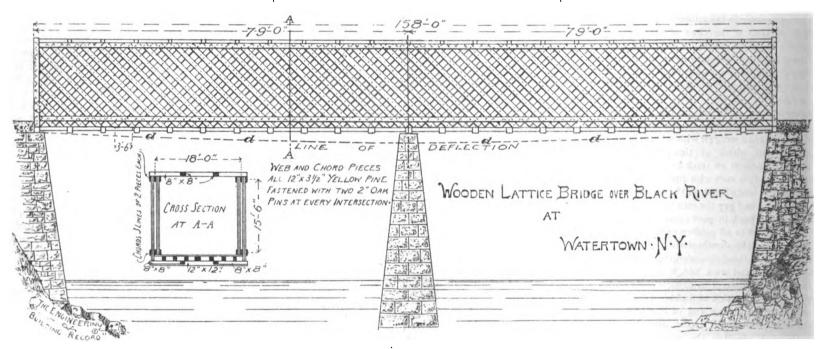
Common Council, was to assess fifty cents per foot street frontage, and seven mills per square foot area of land benefited not extending more than 100 feet from street line, with certain modifications in corner lots and in verying, ularly shaped lots. In the application of this rule no regard was had to the relative value of the different lots, nor to the value of the buildings or other improvements thereon. This, it is claimed, is an unjust and unreasonable rule, and therefore an illegal one.

It must be borne in mind that this is not an ordinary

ax, which, in theory, is a percentage of what a man has, but is a proceeding to recover from proprietors of land some portion of the benefits conferred upon such land by a public improvement for the purpose of defraying the expense of such improvement. It has not been made to appear that the benefits conferred, or the costs of constructing the sewer bear any proportion to the rules. structing the sewer, bear any proportion to the value of land or the value of the improvement thereon.

The following considerations will aid us in estimating

approximately the benefits of a public sewer. place we must premise that in a place like New London a sewer or a system of sewers is a necessity. Individuals



nately the seats on the abutments were ample, and allowed the trusses to pull forward enough to correspond to the deflection of about eighteen inches, which was all the apparent injury caused by the loss of the pier. Considerable alarm was felt, however, by the citizens, who considered the structure very dangerous and closed the entrances, until reassured by the safe passage of a carriage whose driver insisted on crossing. After this the barriers were removed and the usual traffic resumed, the double roadway being often entirely covered with loaded wagons. After a considerable time a trestle bent was placed under the centre of the span, and the bridge blocked up on it to the old level, and eventually the structure was replaced by an iron bridge.

The trusses contained about 37,000 feet of timber, b. m. and together with the rest of the timber, roof, etc., weighed about 200,000 pounds.

Assuming a uniform live load of 75 pounds per square foot of floor (which was probably never attained throughout), the gross load would be about 390,000 pounds, and the maximum chord strain when supported by the centre pier would have been 120,000 pounds, if no allowance were made for continuity.

Allowing 1,000 pounds per square inch as a safe working strain for timber, this would require a net section of 120 square inches, while allowing a loss of one-sixth for splices, and of one-sixth more for pin-holes, the net chord section is 350 square inches, or nearly three times as much as necessary. Even with the centre pier gone and the chord strains quadrupled the strain per square inch of net section

readers, and, we believe, will constitute a valuable precedent for similar cases in the future.

Its more important points are as follows:

The system adopted is excepted to in several particulars.

First.—The outlet is objected to. At present there is but one. The trunk or intercepting sewer already constructed is designed to carry off the sewage from the greater portion of the town. The discharge is into the harbor near the centre of the town. The objection is that there should have been several outlets instead of one. If the sewage was to be discharged into the water in large quantities at or near the shore it might be very objectionable. But the plan contemplates a discharge in the channel several hundred feet from the dock, where there is a strong current which will immediately convey the offensive matter into the sound.

This objection is not well taken.

Second.—That the plan devised does not provide for the drainage of cellars nor the discharge of surface water. So far as the latter is concerned it is obvious that if it had provided for it the sewer must have been much larger, consequently more expensive. But it was unnecessary; the town is on the hillside, so that it is rapidly and efficiently drained with little artificial aid. Moreover, this objection, so far as it exists, is not peculiar to the appellants. It is common to all.

In respect to cellars. They can in nearly all cases be easily and properly drained upon the surface. As the

water is comparatively pure, we see no particular objection

-The next objection is that there is not sufficient fall, it being for a part of the distance but one foot in

This question is mainly one of engineering, and we are satisfied that all was done that well could be to obviate the

cannot, either alone or in combination with others, conduct their own sewage matter to the harbor or coves. Sanitary reasons forbid it. The experiment has been tried by some of the appellants and the result is an intolerable nuisance. desspools may be allowed to some extent in the suburbe but they are objectionable, and in the thickly settled por tions of the town are wholly inadmissible. Assuming, then that a sewer is absolutely necessary, and that each individual may choose between the use of a public sewer and constructing a private one, it then becomes a question of comparative expense.

How much will it cost a man to procure a right of way

and construct a sewer that will discharge its contents into deep water? And how much expense will it be from year to year to keep it in repair? The idea readily suggests itself to the mind that there might be a large saving by

several combining and using one sewer.

That is undoubtedly so; and every business man would at once follow the suggestion to the logical conclusion that one sewer or system of sewers for the accommodation of all would be cheapest and best for all concerned. Obviall would be cheapest and best for all concerned. Obviously no one of these appellants could procure sewerage facilities for the sum assessed against him to say nothing of the expense of repairs from year to year. These suggestions ought to be sufficient to satisfy every intelligent man, not only that a public sewer properly constructed, and permanently cared for, is cheaper and better than any other but also that it benefits property to an amount largely in excess of the cost. largely in excess of the cost.

The benefit, however, is not in proportion to its value.

but is a given sum irrespective of its previous value or of the value of the improvements thereon added to the real worth of the land. It matters not whether the land is improved or unimproved. That is a matter that cannot well be taken into consideration. A lot is occupied to-day; tomorrow a fire may sweep away the buildings and the owner will have no present use for a sewer. A lot is vacant now.



but at any time a building may be constructed thereon and a sewer become a necessity. In either case the sewer is an improvement that adds so much to the value of the land in market. Temporary considerations do not affect the value of the land as such and ought not to affect the amount of benefits assessed. Moreover, the cost of constructing a sewer is not affected by the use or non-use of the laud. It costs as much to construct a sewer for vacant land as for land covered with buildings.

The cost depends in some measure upon its length, and

The cost depends in some measure upon its length, and its length has some relation to the aggregate of land fronting thereon. The benefit conferred is largely in proportion to the quantity of land as shown by its superficial area. On the whole the rule seems to be a just and reasonable one; and it is not claimed that it was unfairly or partially administered. All in similar circumstances fared alike.

The third reason of appeal—that the assessments were exorbitant—the fourth that the lots were not specially benefited, the fifth, that the benefits assessed to the appellants were proportionally greater than those assessed

benefied, the fifth, that the benefits assessed to the appellants were proportionally greater than those assessed to others—are not found true.

The sixth reason of appeal is that the construction of the sewer is of no benefit to the appellants. To sustain this allegation some of the appellants show that they have private sewers into the harbor and coves of the city. In Clapp 25. Hartford, the court held that such facilities should be considered. That would be conclusive were it not for the fact that the circumstances are materially changed. Such private sewers in these cases are nuisances and should be abated. As such they are prohibited by the statute, and the city has the power to compel every man to sewer into the public sewer. To giving the city such power in the case of nuisances there can be no legal or constitutional objections; and that too without compensation. If the sewers were unobjectionable it would present a different question. One of the appellants discharges his sewer into the dock; that is only less objectionable, still it is prohibited, and we think properly so.

One of the appellants complains that there is no fall between the bottom of the curbstone in front of his land and the the too of the saver: the difference however is a clight.

One of the appellants complains that there is no fall between the bottom of the curbstone in front of his land and the top of the sewer; the difference, however, is so slight that the objection is easily obviated in either one of two ways, by having a lower discharge into the sewer, or it desirable that it should be at the top, the sewage from the closets and sinks can be at a higher level than the curbstone, in which case the depression under the curbstone will occasion no inconvenience, but on the contrary will operate as sion no inconvenience, but on the contrary will operate as

Others of the appellants have cesspools. Probably most of the inhabitants of the town had some such facilities. They are a poor substitute at best for a good sewer; and much inconvenience and more or less danger are to be apprehended from their use; when it is further considered that the board has power by the express provisions of the ninth section of the act to compel all persons to connect with the sewer, the cesspools become in effect of no consequence.

One of the appellants is blind, and he claims exemption from assessment by the general statute exempting from taxation to a certain extent the property of the blind. This is not such a tax as the legislature in providing for exemption contemplated. We are constrained, therefore, to hold that the assessment is not illegal on that ground.

CEMENT MORTARS FOR USE IN PUBLIC WORK.*

No. II.

(Continued from page 253.) ADHESION OF MORTARS.

In the foregoing the subject of the tensile strength, In the foregoing the subject of the tensile strength, tenacity or cohesion of cement mortars has been considered, but another equally important quality, namely their adhesion to the bricks or stones, which are to be cemented together, must also be taken into account. On this particular point altogether too much appears to be taken on simple faith, since the records of experiments bearing directly thereupon is vastly smaller than in the case of cohesion. It is commonly assumed that after the lanse of cohesion. It is commonly assumed that after the lapse of a moderate time the adhesive and cohesive strength of cement mortars are about equal, and that in old work the former exceeds the latter. Modern experiments, however, fail to establish the truth of this assumption, and indicate rather that the adhesion of such mortars to bricks or stones is much less than the tensile strength during the first few months; also that the relation between the first few months; also that the relation between the adhesive and cohesive strengths of both neat cements and mixtures with sand are very obscure. It has been found that the adhesion of mortars to bricks or stone varies greatly among the different kinds of these materials, and particularly with their porosity; it also varies with the quality of the cement, the character, grain and quantity of the sand, the amount of water used in tempering, the amount of moisture in the stone or brick, and the age of the mortar. Some cements which exhibit high tensile strength, give Some cements which exhibit high tensile strength, give low values for adhesion, and conversely, cements which are apparently poor when tested for cohesion, show excellent adhesive qualities. Quick-setting cements are usually found to give greater adhesive strength than slow-setting ones, while in the case of cohesion the opposite is generally true. Under these circumstances, therefore, it is manifest that a test, at various stages of age, of the adhesive properties of a binding material like cement mortar should be regarded as a very important one, in the case of masonry structures which must soon after completion be subjected to other than compressive strains, and it is to be regretted that so comparatively little information respecting such

*Abstract of a report by the Executive Board of the City of Rochester, N. Y., prepared by Emil Kuichling, M. Am. Soc. C. E.

tests with cements and mortars as made at the present time, is available.

The authorities with reference to the strength of mortars

usually quoted by the compilers of modern manuals on engineering subjects, can fairly be considered as somewhat out of date, as many of them experimented in the early part of the present century with limes, mixtures and methods of preparation different from those now in common use on public work; and hence the measures of strength given by these experimenters may reasonably be regarded as varying more or less from what is to be expected of the binding material used in structures now in process of erection. In view of the fact, however, that but few others relating to adhesion are accessible, they are herewith submitted.

herewith submitted.

According to Rondelet, the adhesion of common lime mortar to stone and brick after one year is greater than its cohesion, and after six months it is about 15 pounds per square inch for compact limestone, and 33 pounds for brick. Plaster of Paris, or gypsum, he rates as having a tensile strength of 76 pounds per square inch, and an adhesion of about 50 pounds, which latter, however, diminishes greatly with age

sion of about 50 pounds, which latter, however, diminishes greatly with age.

Gen. Pasley gives about 140 pounds per square inch as the average adhesion of Portland cement to bricks. Vicat takes the adhesion as equal to the tensile strength of the cementing material, giving the following values thereof in pounds per square inch, one year after mixture: Good hydraulic mortar, 140 pounds; ordinary hydraulic mortar, 85 pounds; good common (quicklime) mortar, 51 pounds; inferior common mortar, 21 pounds.

As M. Vicat states that the best proportions of mixture are 2.4 measures of sand to one of quicklime, and 1.8 measures of sand to one of good hydraulic lime, it may be inferred that his tests were made with such mortar.

inferred that his tests were made with such mortar.

For a hydraulic mortar made of equal parts of cement and sand, Mallet, in 1829, found an adhesion of about 70 pounds per square inch when kept in air, and of about 99 pounds when kept under water, both for considerable

periods of time.

In 1832, Mr. J. White made some experiments with blocks of brick masonry, using a hydraulic mortar composed of lime, puzzolana and sand, and found that the cohesive strength of the entire mass, after one month, was about 5 pounds per square inch, and after nine months, about 8 pounds.

In 1858, Mr. Robertson, an English engineer, carried put a large number of experiments on the adhesion of both cement and common mortar to bricks, and found that in cement and common mortar to bricks, and found that in the case of cement, such adhesion at the end of one week after mixture varied from 23 pounds to 15 pounds per square inch, according as the cement was quick-setting or slow-setting, and after four weeks, from 30 pounds to 50 pounds per square inch, under the same circumstances. With common mortar, well ground and six months after mixture the adhesion was found to range from to pounds. mixture, the adhesion was found to range from 40 pounds to 18 pounds per square inch, depending upon the quality of the brick, the hardest and densest giving the higher values, and the softer and more porous varieties the lower ones. The inferior results obtained with the soft brick are ascribed to the water in the mortar being absorbed by the bricks and consequently not being available for the process of crystallization.

process of crystallization.

A few years later, Gen. Q. A. Gilmore, U. S. A., conducted an extensive series of tests of limes, cements, and mortars, in the course of which the adhesion of cement mortar to bricks and granite, after 29 days and 320 days, was determined. Rosendale cement, mixed with various proportions of sand, was here used, with the result that the adhesion was found to vary with the quantity of sand in the mixture, and to be considerbly less than the cohesive strength of the mortar at the same age. The figures /thus derived are all given in Table No. 2, hereunto appended, but it may be remarked that after 29 days, the adhesion of mortar made of equal parts of cement and sand was only about 16 pounds per square inch to bricks and adhesion of mortar made of equal parts of cement and sand was only about 16 pounds per square inch to bricks and 21 pounds to finely cut granite, and when mixed in the proportion of two parts of sand to one part of cement the adhesion was only 12 pounds, whereas the tensile strength of similarly prepared Rosendale cement mortars, four weeks old, will be found to be much greater. The twentynine days' test was made with great care, with mortar of the consistency ordinarily used for brick masonry, and the bricks having first been properly wetted and afterwards moistened every alternate day. In the cases where the mortar was allowed to set for 320 days, the materials remained exposed to the air in a room without further attention, and upon being torn apart the adhesion to the bricks, mained exposed to the air in a room without further attention, and upon being torn apart the adhesion to the bricks, the cohesion or tenacity of the mortar, and the cohesion of the bricks themselves, were all found to be about the same, or about 68 pounds per square inch, when the cement was used neat or pure; further, when equal parts of cement and sand were used the cohesion and adhesion were each about 40 pounds, and when two parts of sand to one part of cement were used the cohesion and adhesion fell to 24 pounds per square inch.

Many experiments on the adhesion of Portland cement mortar to various qualities of brick were also made between 1802 and 1870, by Mr. John Grant, C. E., for the Metropolitan Board of Works, and with particular reference to the construction of the large intercepting sewers of London. In these tests the cement was used neat, and

of London. In these tests the cement was used neat, and also after being mixed with an equal volume of sand, the latter being the proportions used in the work. After the mortars had attained an age of twelve months the bricks were torn apart and the adhesion was found to range from 40 lbs. to 126 lbs. per square inch with neat cement, and from 29 lbs. to 83 lbs. per square inch with equal

parts of sand and cement, depending upon the quality of of the bricks and whether the pieces had been kept in air or in water. Here again it is found that the adhesion is far less than the tensile strength of similar Portland cement mortar of the same age.

In 1873 a number of tests of the adhesive strength of mortars made of Bonn and Perlmoos Portland cements, and also of Perlmoos hydraulic lime, all mixed with clean and relatively fine river-sand, were made by Prof. Bauschinger, at the Royal Testing Laboratory of Munich. The substances cemented together were common bricks, arranged in pairs, which were torn apart after from six to sixteen weeks. The adhesion ranged from 69 lbs, to 13 lbs. per square inch, depending upon the quality of the cement and the amount of sand used, and was far less than the tensile strength of the mortar of the same age, nor was the tensile strength of the mortar of the same age, nor was any definite relation found to exist between the two series

A similar set of experiments with the Bromberg hy-draulic lime was carried out in the winter of 1882 3, at the A similar set of experiments with the Bromberg hydraulic lime was carried out in the winter of 1882 3. at the Royal Testing Laboratory at Berlin, by Dr. Böhme. The mortar was made with standard quartz sand, in varying proportions and applied to common bricks, the joints being torn apart after one, four, and thirteen weeks respectively. At the same times the tensile strengths of the mortars were separately tested. The results obtained showed the adhesion to range from 42 lbs. to 13 lbs. per square inch, according to age and quantity of sand, the higher value being obtained after ninety days, with neat cement or mortar with equal parts of cement and sand, and the lower one after one week, with mortar made in the proportions of one part of eement to four parts of sand. Further, by comparing the tensile and adhesive strengths at the same ages, it was found that the former was about ten times greater than the latter at all times when the mortar consisted of one part of cement to three or four parts of standard sand; also from six to eight times greater, both when the cement was used neat and when the mortar was mixed with one part of cement to one or two parts of the same sand. These results are of great interest, inasmuch as they indicate a definite relation between the two tests, thus leading to the inference of the one from a knowledge of the other.

Other interesting experiments on the adhesion of cement mortars to brick-work were made last year by Prof. Warn

one from a knowledge of the other.

Other interesting experiments on the adhesion of cement mortars to brick-work were made last year by Prof. Warren, of Sidney University, New South Wales. Portland cement and three different qualities of sand were used, with results, after seven days, ranging from 117 lbs. to 9 lbs. per square inch, according to the kind and amount of sand, and after twenty-eight days, from 146 lbs. to 14 lbs. per square inch. The highest values were almost invariably obtained when crushed sandstone was used in making the mortar, and the lowest when river-sand was used. The tensile strength tested neat was 607 lbs. per square inch, after seven days, and 740 lbs. after twenty-eight days.

rhe most recent experiments on the adhesion of cements The most recent experiments on the adhesion of cements to a variety of different substances used in the construction of public works are those made by Mr. Isaac J. Mann, C. E., and submitted in 1883 to the Institution of Civil Engineers. Mr. Mann urges that as the principal function of cement in masonry structures is to produce adherence or a binding together of the loose or disconnected material, its value should be estimated by its adhesive strength, after a certain lapse of time, rather than by its cohesion, which latter is always considerably greater. In his experiments, however, he uses neat cement only, and his experiments, however, he uses neat cement only, applied in a very thin layer between two blocks of the material to be cemented together. For estimating the relative adhesive strengths of different brands of cements, the latter, after being properly tempered neat, is placed between two small strips of sawed limestone or ground plate-glass and allowed to set for specified periods of time, after which the force required to tear them as under is duly after which the force required to tear them asunder is duly measured. The average of a number of tests thus made with neat Portland cement on limestone showed an adwith near Portland cement on limestone showed an adhesion of 65 lbs. per square inch after seven days, and of 99 lbs. after twenty-eight days; the tensile strength of briquettes made and tested in the usual manner being about 430 lbs. in both cases. For chiselled granite and common brick, after seven days, the adhesions were 78 lbs. and 19 lbs. per square inch respectively. It was also found that the roughness or smoothness of the cemented surfaces did not affect the adhesive strength as much as had been use not affect the adhesive strength as much as had been sup-posed, but it varied with the quality of the substances to which the cement was applied. The adhesion was better to very hard surfaces, such as granite and ground plate-glass, than to softer material like common bricks.

glass, than to softer material like common bricks.

With regard to the shearing strength of cement mortar, or its resistance to the sliding of one stone or course over the one next below, but little in the way of direct experiments has been published. Rondelet states that for common lime mortar, six months old, this shearing strength is only about 5 lbs. per square inch. Boistard's experiments with mortar made in the proportions of two parts of sand to one of lime, placed between two blocks of roughly dressed limestone and then allowed to dry for 16 days, gave a shearing strength ranging from o lbs. to 15 lbs. gave a shearing strength ranging from 9 lbs. to 15 lbs. per square inch, according as the area of the bed increased from sixteen to sixty-four square inches; with a mortar made of one part lime and two parts cement, on the other hand, he found, under the same conditions, a shearing strength of only about 5 lbs. per square inch, on the average.

In recent times, elaborate experiments to ascertain the shearing strenth of mortar, both in the joints of brick-work and separate blocks, have been made by Prof. Bauschinger, of Munich. The results are too numerous for a verbal

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description and they are accordingly given in Table No. 3, hereunto appended. None of the values obtained are very large, ranging after ninety days from 70 lbs. to 7 lbs. per square inch on brick-work with mortar mixed in the proportion of three parts of relatively fine river-sand to one of cement or lime. The shearing strength of cubes of mortar also appears to be considerably greater than that of the comparatively thin joints in brick-work, and to be influenced by the quality of the sand.

As in the case of adhesion, no exact relation between the tensile and the shearing strengths of mortar placed in

As in the case of adhesion, no exact relation between the tensile and the shearing strengths of mortar placed in brick-work can yet be deduced, owing to the lack of sufficient data; but on the other hand, the experiments show that the shearing strength of blocks or cubes of mortar is about twenty per cent. greater than the tensile strength under the same circumstances.

The method of testing cement mortars for their adhesion to building materials is accordingly one of great practical importance, and which should commend itself to the favorable notice of those who have the opportunity to make such experiments; for while the test of cements and mortars for tensile strength is of great service in forming estimates of their value, we have the strength in the forming estimates of their value, we have the strength in the strength in the strength in the strength in the strength is of great service in the strength in the strength is of great service in the strength in the forming estimates of their value, yet it cannot be denied that their adhesive properties actually limit and concition the cohesive strength of the mass of masonry itself, bethe conesive strength of the mass of masonry itself, because in any section through or parallel to the courses or beds of the brick or stone work, the aggregate area of the surfaces affected by the adhesion of the mortar will generally be far in excess of that affected by its cohesion. If we conceive the stones or bricks removed from a wall without disturbing the mortar or binding material, the without disturbing the mortar or binding material, the latter will form the sides of a series of cells, more or less regular in shape, depending upon the form of the blocks conceived to be taken out; and the strength of these sides in the structure will differ according as they represent the adhesion or the cohesion of the mortar. For example, in the case of a vertical wall, whose upper portion is over-thrown by a lateral force or pressure of any kind, the failure occurs either by rupturing the adhesion in the beds and the conesion of the side joints, or by the rupture of the mortar in the beds alone. The latter course, however, is improbable, since the cohesion of cement mortars is always much greater than their adhesion, as shown in the foregoing; and hence, in estimating the resistance of the wall to overturning, it becomes necessary to fix values for both the cohesive and adhesive strength of the mortar at the time when the structure is first exposed to the action of the lateral force or pressure, and also to ascertain the relative areas of beds and side joints in the assumed section of rupture. In good brick work the aggregate area of the side joints, in any section parallel to the beds, will amount to about one-seventh of the total area of such section; and in stone-work it will vary from about one-third to one-eighth, according to the quality of the dressing and laying: hence it follows that the adhesive strength of the mortar will, in a case like the above, be called into action for much the greater portion of the entire sectional area of the wall, while its tensile strength will apply only to the small remainder. In fresh work, therefore, the strength of the cement mortar will govern that of the whole mass, and a knowledge of its tensile strength becomes eminently useful only as it can be considered a correct index of its adhesive strength to the materials which are to be bound together. The experiments heretofore made, however, indicate that the relation between the cohesion and adhesion of a cement mortar is still obscure; and until further investigations have been carried out in this direction, it will become advisable to remain on the safe side by specifying and using mortars richer in cement, instead of im-perilling the durability of the work with mortars containing relatively large admixtures of sand. In problems of the nature now under consideration, where the data necessary to a complete demonstration are indefinite or uncertain, and where the efficient supervision of the work during construction is of paramount importance, it has always been regarded as perfectly legitimate for the engineer to adopt such a course and to provide for the greatest possible, as well as the greatest probable, stress which may reasonably be expected to act upon the masonry; and hence, under such circumstances, the specification of mormeagre in cement becomes unjustifiable and of doubtful economy.

. (To be continued.)

THE ACTION OF BOSTON WATER ON CERTAIN SORTS OF SERVICE PIPE.*

ALTHOUGH galvanized pipe is used to a considerable extent for distributing soft water, and although the general nature of the action of water upon zinc is known, there are very few results of quantitative analysis accessible which show the amount of zinc actually taken up by the water under the circumstances of ordinary practice. We have recently made some experiments in this direction.

tion.

The principle on which the so-called "galvanizing" process rests is that, under ordinary circumstances, zinc is slightly electro-positive to iron, and if the two metals in intimate contact are simultaneously immersed in water the zinc will be acted upon rather than the iron. This principle is only partially realized in practice. As long as the zinc coating is perfect the iron is protected, but if the zinc coating be imperfect, or if it be removed, as it is liable to be in coupling pipes together, then the iron is acted upon

*This paper was prepared by the late William Ripley Nichols, member of the Boston Society of Civil Engineers, and L. K. Russell. It was read before the society by Prof. L. K. Norton and published in the Journal of the Association of Engineering Societies.

as well and compounds of zinc as well as of iron are formed and carried fofward with the water, or form a sediment which gradually chokes up the pipe. One of us has already stated elsewhere, as the result of experience, that it will usually be found possible to detect zinc in water which has passed through any considerable length of zinced pipe, and has expressed the opinion that with most waters which are used for water-supply the amount of zinc in suspension—generally a hydrocarbonate—and in solution (in whatever form) is too inconsiderable to form the basis of a sanitary objection to the use of the pipe.

objection to the use of the pipe.

In our recent experiments we employed a length of about thirty-nine feet of half-inch galvanized pipe connected with the water service of the building in such a way that the water in the pipe could at any time be displaced by fresh water without allowing air to enter. Usually for a test an amount of water was drawn off equal to or slightly greater than the capacity of the pipe.

than the capacity of the pipe.

The experiments were continued during a period of three months. We found zinc in solution and in suspension, in not widely varying amounts, whenever water stood in the pipes from seven to seventy hours.

in the pipes from seven to seventy hours.

Water standing several days in the pipe contained no greater proportion of zinc in solution, though that in suspension was increased, and at the end of the three months the quantity of zinc found was only slightly less than at the beginning.

the beginning.

The water contained in solution 0.3 to 0.6 parts of zinc per 100,000 and in suspension 1.5 to 2 parts per 100,000, or 0.3 grain per gallon in solution, and 1.0 grain per gallon in suspension. No zinc was found in water with the regular flow, but when the rate was decreased to about one quart per hour, 0.9 parts per 100,000 of zinc in solution and suspension was found.

The inevitable inference to be drawn from these results is that the zinc coating is slowly but continuously dissolved, and it becomes a question of interest to consider the length of time the coating will last. Some experiments on the thickness of the zinc coating and the depth to which it penetrates the iron were made.

Some rods of wrought iron about six inches long were carefully centered and turned off by a lathe for about four inches of their length. The diameters of these were measured with a micrometer screw caliper measuring to one one-thousandth of an inch. The rods were now treated exactly as iron pipe is galvanized—i. e., by dipping the iron previously cleaned by immersion in muriatic acid, into a bath of melted zinc, with frequent additions of salmoniac, the centering being preserved by filling the holes with putty, which was afterwards easily dug out. The increase in thickness was noted. The rods were turned down by this amount, the turnings collected and analyzed for zinc and iron. Other turnings followed of varying thickness which were also analyzed.

zinc and iron. Other turnings followed of varying thickness which were also analyzed.

The results are given in the following table. The measurements show the thickness of the consecutive layers removed:

No. of rod.	No. of consecutive turning.	Diameter before galvanizing. In inches	Diameter after galvanzing. In inches	Thickness of turning.	Per cent. Iron.	Per cent. Zinc.
1	1 2 3 1 2 3 1 2 3	.901 .901 .901 .901 .901 .901 .901	.905	.002 .0035 .002 .003 .003 .0025 .002 .0025	2.19 93.31 96.04 1.87 65.24 1 70 02.03 87.09	97.08 4.33 .98 96.42 33.18 tr. 97.20 33.95 13.23

This table shows the increase in thickness due to galvanizing to be a ring of two one-thousands of an inch thick and that zinc does penetrate slightly into the iron, forming an allow

ing an alloy.

It will be seen that at the rate of wear indicated in the first series of experiments the coating of zinc would not last many months.

The zinc coating is not an even layer over the whole surface, but is thinner in places. This was made evident by experiment as follows: On immersing one of the galvanized rods or a piece of pipe in water, points of iron rust appeared at irregular intervals. In the water drawn from the pipe as above described some iron was always found with the zinc.

Some experiments were also made to ascertain the composition of the insoluble precipitate formed by the action of water on zinc. A quantity of chemically pure zinc was placed in a large flask and covered with filtered Cochituate water. The precipitate formed was collected from time to time, and was dried over sulphuric acid, and the water was renewed; one portion contained

ZnO 73.68 H₂O 16.90 CO₂ 10.02

Another portion dried longer gave

H₂O 10.98 CO₂ 10.58 100.00 This composition nearly corresponds to 5H₂O,2CO₂. 8ZnO. This zinc hydrocarbonate differs somewhat from those investigated by Rose and v. Pettenkoffer.*

At the same time as the foregoing experiments, tests were made of a pipe protected by a coating of lead, tin and antimony (in the proportion of about 80-12-8 in the sample examined) instead of zinc. The pipe is called kalamein.

Our experiments show that the coating on our sample is not evenly laid on, the spots of iron showing as referred to in the case of the galvanized pipe. Our experiments extended over nearly a month, and the amount of lead and tin in the water drawn from the pipe was not appreciably diminished at the end of the time.

read and the first water drawn from the pipe was not appreciably diminished at the end of the time.

We also arranged brass pipe in the manner described for the galvanized, except that the two ends were connected so as to enable us to heat the lower part and keep up a circulation of water through the pipe, and to ascertain what metals, if any, went into solution. Zinc and copper were found in small quantities, but constantly present.

As a further evidence of chemical action, the dissolved oxygen in samples of water which had remained in contact with the pipes for fifteen hours was determined by Schutzenberger's method, fully aerated Cochituate being taken as a standard, and the tests being made for several days in succession.

Freshly drawn and fully aerated Cochituate gave per cents, of dissolved oxygen as follows:

Kind of Pipe. Common iron pipe, from faucet in the laborator hours' contact	Dissolved Oxygen, ry, after 15
Brass pipe	
Galvanized pipe	
Kalameined pipe	0.06

COPPER PIPES MADE BY ELECTROLYSIS. THE recent accident to the steam-pipe of the steamship

Elbe lends a special interest to the electrolytic process for the manufacture of copper now being practiced by Mr. W. Elmore at Cockermouth. The London Engineer says that by this method such an article as a steam-pipe can be produced without weld or joint, and having a tensile strength from 50 to 100 per cent. in excess of first-class brazed pipes. Further, this result can be attained with the use of a very inferior quality of copper, and at a cost which will enable the electrolytically-made article to compete in the market with the customary varieties. Of course there is nothing new in depositing copper in a tubular form, but hitherto such metal has been too brittle to render it reliable for use in circumstances under which it is exposed to great stress. For copying engraved plates, and for the rollers of calico-printing machines, deposited copper has been used with great success, and when it has been thrown down very slowly it has been possible to produce very satisfactory qualities of metal for these purposes. The novelty introduced by Mr. Elmore, however. lies in breaking down the crystals almost immediately they are formed, and pressing them out into a fibrous form, in which they are interlaced and matted together. To this end the iron core or mandrel on which the metal is deposited is kept constantly rotating in the bath, and an agate burnisher is slowly moved backwards and forwards lengthwise of the cylinder, as if to cut a screwthread upon it. The speeds are so arranged that a layer of copper seven-thousandths of an inch thick is deposited between each reciprocation of the burnisher. When the required thickness has been attained the mandrel is lifted out of the bath and placed in a vessel supplied with superheated steam. In a few moments the expansion of the copper detaches it from the iron, and the shell can be stripped off. Pieces cut from such tubes have been submitted to breaking tests by Messrs. Kirkaldy & Co., Professor Kennedy, and Professor Unwin, and have broken at strains varying from 27 tons to 41 tons per square inch, with an extension varying from 5 per cent. to 7½ per cent. in a length of ten inches. The metal can be worked under the hammer most easily, and can be drawn, bent. or compressed without annealing and without any tendency to crack. Specimens poished and submitted to the microscope show that the electrolytic metal has a perfectly compact and homogeneous structure, while drawn copper is a honeycombed mass of crystals, only connected together at points. The success which has attended the experimental stage of Mr. Elmore's process encourages the belief that absolute security from burst copper steampipes can be secured in the future, and that we are on the eve of being supplied with a greatly improved quality of copper for all purposes.

^{*} Note.—Rose, Pogr. Ann. 85, 107-141. Also v. Pettenkoffer Abh. D. Tech. Commission, I., 149.



DOMESTIC ENGINEERING, ETC., EQUITABLE LIFE INSURANCE BUILD-ING, NEW YORK CITY. No. VIII.*

> (Continued from page 711, Vol. XVI.) PLUMBING DETAILS.

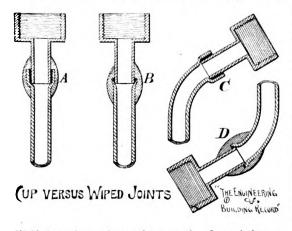
WE this week conclude our descriptions of the plumbing in the Equitable Building with an account of the justcompleted bath-room in the Lawyers' Club apartments. The bath-room, adjacent to the dressing-room (see Fig. 1), contains three tub and shower baths and one needle-bath, each in a separate marble-paneled alcove (see Fig. 2). The bath-room is well lighted by external windows opposite the interior ones shown in the illustration. The floor is laid with Italian marble tiles. The wainscot is Italian marble, about seven feet high. The cornice and window trim is of grained oak and the ceiling frescoed in colors.

The tubs are porcelain, resting on carved marble feet, and capped at the upper edge with a marble rim, molded outside and beveled inside, as per sketch, Fig. 2. All the fixtures and visible metal work (except the polished brass door-hinges) are silver plated, and the pipes are led behind the wainscot paneling; this paneling was not at first contemplated and its adoption necessitated the vent to the bath-trap to pass under the paneling and connect behind it with the main vent-pipe. The waste-pipe trap is accessible through a handhole in the floor, covered by the convex silver-plated cap, shown in the illustration at the foot of the tub.

In addition to the regular plumbing-work described in this and previous issues, the plumber, Mr. W. H. Quick, has fitted up a novelty in the way of a dish-washing machine. which we illustrate in our "Novelty Column" elsewhere

CUP VERSUS WIPED JOINTS.

THE following illustration should have accompanied Mr.



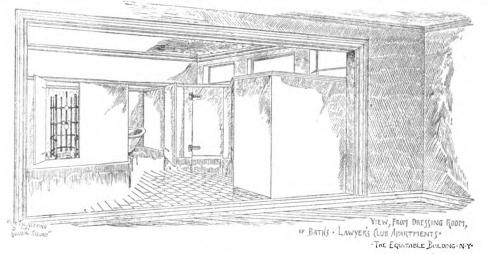
Kirk's letter in our issue of last week. Its omission was through inadvertence.

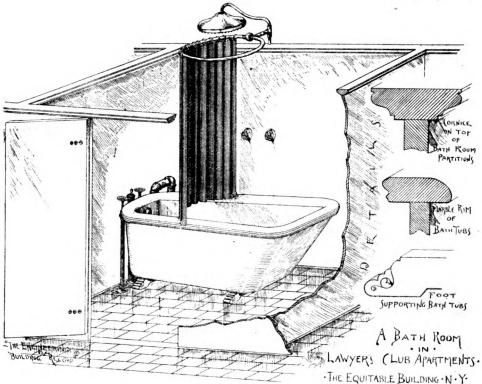
BILLINGS, MONT., March 17, 1888.

BILLINGS, MONT., March 17, 1888.

SIR: I have read with considerable interest the correspondence between Mr. Kirk and William R. Billings as to the merits of cup joints versus wiped joints. I agree with Mr. Kirk, and will always stick to the wiped joint. I, like every other plumber, will naturally stay by the latter joint (providing he can make one). But, aside from this, I think the wiped joint is the best in all cases, which I will try to demonstrate by the assistance of the enclosed cuts. Figure I represents a piece of lead pipe and a solder nipple fastened together by a cup joint. In opening the lead pipe to receive the nipple it is necessary to cup or flange the end of the pipe. This leaves the pipe (after joint is made) below the end of solder nipple about one-half its original thickness, and nothing on the outside of pipe at this point to protect it against internal pressure,

* No. I. of these articles, containing the first installment of Sketches of Plumbing, appeared in our issue of October 8, 1887; No. II., General Description of Building and Plant, October 15; No. III., Details of Pumps and Boilers, October 22; No. IV., Smoke-Stack and Passenger-Elevator Water-Supply, October 29; No. V., The Elevators, November 5; No. VI., Pneumatic System, November 12; No. VII., Steam-Heating, November 10.

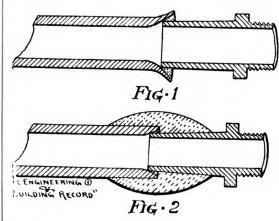




while in a wiped joint, if prepared and made properly, making a rough estimate, I would say there is three times the strength of the lead pipe, which any one can see by reference to Fig. 2.

the strength of the lead pipe, which any one can see by reference to Fig. 2.

In regard to a wiped joint's giving out under different temperatures of water, I would state that they never do, except under an extreme high temperature. I agree with Mr. Billings that the giving out is caused indirectly by expansion, but directly by the mode in which joint is prepared before wiping. As an example we will suppose a joint is wiped over Fig. I. The pipe being plugged leaves a projection all around



same, and when a joint is wiped over the pipe the solder fills the cup as well as covering pipe. Now, what I claim is this, that the cup or flange pulls the joint apart during the operation of expansion. On the other hand, if a pipe is prepared like Fig. 2—that is, tapped out with a tapbore instead of being plugged out with a turn-pin—I claim that there will be no resistance to the lead pipe and joint will not break. What I draw my conclusion from is this: that nine times out of ten when I have found joints broken from the effects of extreme heat I have always noticed that they were parted in the centre.

A cup joint may do in some cases, but on a hot-water pipe it would never work; for this reason, when the solder expands it forces the lead cup out before it (the lead) has

had a chance to get warm, and when solder contracts again it leaves the cup part of joint larger than it originally was intended to be, and this expansion and contraction will soon work a cup joint loose.

Hoping more of your readers will give their views on this point, I am yours respectfully, GEORGE SOULE.

NEW HAVEN, March 21, 1888.

New Haven, March 21, 1888.

Sir: In your issue of March 17 on wiped and cup joints, Mr. J. B. Patterson says he has seen wiped joints stretch and crack in the middle where a cup joint will not. In the first place, a cup joint has no middle to crack in, and he nor any other man ever saw a wiped joint that was properly prepared and wiped crack or stretch. A joint that the pipes are prepared right and wiped even with fine solder will last as long as the pipe it is wiped on. He may have seen a joint crack where there was a piece of iron or brass wiped into the lead. But if he ever noticed he will find that it was the tinning that was eaten off the brass or iron, which in time will eat through the joint. I think that what Mr. M. Sexton says is right, and I think he has had as much experience as Mr. J. B. Patterson.

Yours respectfully, T. A. JARRETT.

INSTRUCTION IN LEAD-BURNING.

APPLETON, Wis., March 26, 1888.

SIR: I am a subscriber to your paper and would be glad to get a little instruction from some one of our pracglad to get a little instruction from some one of our practical lead burners in regard to burning upright seams, as I find it a rather difficult job to do. I have a machine for that work and can burn the flat seams satisfactorily, but the upright seams are what bother me. Any information in regard to the same would be thankfully received.

Yours truly, H. N., Plumber.

[Referred to our readers.]

MACHINE FOR DRILLING CEMENT PIPE WANTED.

CEDAR RAPIDS, IA., March 24, 1888.

SIR: Will you kindly inform me through your most valuable paper next week if there is a machine of any kind made for boring holes in cement pipe instead of cutting with a chisel and hammer, as we are having great trouble here with the pipe breaking up. If you know of any machine or any other way to cut in for connections please let me know.

W. A. D:CKERSCN

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COATING OF SOIL-PIPES—NEED OF TRAP-VENTS.

BROCKVILLE, ONT., March 8, 1888.

SIR: Would you kindly give space for the following

queries in your paper t

First—In the latest plumbing rules for the city of New

First—In the latest plumbing rules for the city of New York, why are soil-pipes to be uncoated?

Second—Where main soil-pipe passes unobstructed through roof should water-closet trap be vented where closet is the highest fixture, or should it be vented if there are no closets above it? If so, why?

Third—Some boards of health consider that the longer the branch pipe or waste from any fixture (except a water-closet) the less need of a vent to trap of such fixture. Others consider that the shorter said pipe the less need of a vent. Which is correct, and why?

need of a vent. Which is correct, and why?

Fourth—In the hotels and business houses of our city water-closets are in the basement with unvented traps. The fixtures in stories above basement are wash-bowls sinks, etc., with an occasional water-closet. Should a Should all traps in these cases be vented?

aps in these cases be vented r

By commenting on above you will greatly oblige,

Vours truly. New Subscriber.

First-The amended rules required that pipes should not be coated, because experience showed that sand holes and defects in the pipe were concealed by the tar coating.

Second-The necessity for it depends on the circumtances in each case.

Third-The vent is needed in either case.

Fourth-In new work traps should be so placed that they may all be vented. In old work there may be special instances where a compromise in the shape of a deep seal trap without special vent would be the most practicable thing to adopt. Traps are vented not only to prevent syphonage, but to permit a circulation of air through the branch waste-pipes, and thus through the drainage system of a house.

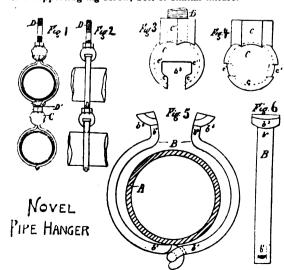
So much space has been taken up in the earlier issues of this journal in discussing this question, that we must refer our correspondent to these articles, especially "Report of Tests," by E. S. Philbrick and E. W. Bowditch, to the National Board of Health, Vol. VI., pages 264 to 267, and Glenn Brown, in issue of December 11, Vol. XVI. "Plumbing and House Drainage Problems" also discusses this matter. Any of these volumes are obtainable of the Book Department of THE ENGINEERING AND BUILDING RECORD.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, oeing governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

PIPE-HANGER.

A DEVICE recently invented and patented by Harry Trask, of Trask & Carmichael, 80 Centre Street, New York City, for suspending pipe so as to admit of easy adjustment and free movement in any direction, consists essentially of a yoke connected by a ball and socket joint to a supporting lag-screw, bolt or similar fixture.



The lag-screw D (Figs. 1, 2, 3) is driven in the ceiling or other support, and the hollow sphere C is screwed on to it by the threaded lug C'.

B B (Figs. 5 and 6) are interlocking arms of the pipe yoke and have a hooked shoulder b^3 with a spherical

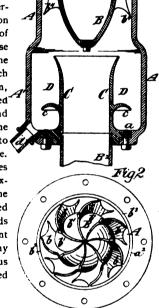
bearing surface to fit the inside of C. The yoke arms B B (Figs. 5 and 6) may be hooked together around the pipe A, and their necks and shoulders b4 and b8 inserted through the T-shaped slot cc' c' c in C, then lowering them until the shoulders b8 b8 bear on their seats cc on the concave interior surface of C will lock the yoke and permit oscillations of the enclosed pipe.

By making the lower ends b' b' (Fig. 5) of the yoke segments B hook into an auxiliary lug D' (Figs. 1 and 2), a duplicate yoke and joint may be provided for a second line of pipe, and so on, extending the system as far as

STEAM AND WATER SEPARATOR.

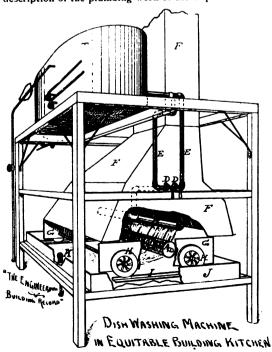
THE operation of this device, recently patented by J. Joseph De Rycke, of New York City, is clearly shown by reference to the accompanying illustration.

The steam enters at the top of the separator, and as it passes downwird is given a rotary motion by the spiral ribs on the central core. The centrifugal force generated by this rotation throws the particles of entrained water or grease to the outer wall of the separator down which they flow to the bottom, where they are carried off by the drain-pipe and either returned to the boiler or discharged into some suitable receptacle. The steam escapes through the dry pipe extending up from the bottom and the curved flange which surrounds it is intended to prevent the splashing up of any fluid which might thus again become mixed with the steam.



DISH-WASHING MACHINE.

THE novel device for washing dishes referred to in our description of the plumbing work of the Equitable Build-



ing elsewhere in this issue, consists, as shown in accompanying illustration, of a wooden frame, supporting on top the hot-water tank T, underneath which, enclosed by the galvanized iron hood F, is the spray-tube B. The tank, T, is double, the hot water in one side being pure and in the other containing a quantity of soda in solution. The pipes E E lead from these respective divisions of the tank, either of which can be connected at will by valves D or D with the pipe B, whose lower side is perforated so as to eject a solid sheet of water, which escapes at considerable pressure and plays upon the dishes in the frame A. These plates, etc., are placed edgewise in separate cross-racks in skeleton cylindrical frames, two of which are set inside the larger similar frame or cage A A.

The car G G has galvanized iron sides, but no ends or bottom, and travels, with grooved wheels H H, on the rails I I. It can be moved from beneath F, and receives two of the frames A A, which, after being rolled back under the spray, are revolved by cranks attached to the gudgeons at the ends opposite to that shown in the illus. tration.

The track I is laid on the bottom of the galvanized iron pan J, which catches the water and discharges it through basket strainer K.

The soda water is first turned on and removes the grease, etc., from the dishes, which are then rinsed by a jet of pure water, which is so hot as to quickly evaporate and make further drying unnecessary.

The machine is claimed to reduce breakages and do the work of ten persons.

It is invented and patented by J. Haskins, Chicago, Ill., and is one of the first that has been put in use.

A LONG STEAM-GAUGE PIPE.

MR. WFLLS, superintendent for Gillis & Geoghegan, recently had occasion to place a steam-gauge 100 feet hori. zontally and 20 feet vertically above the main steam-pipe whose pressure it was desired to register. The connection was made with a half-inch pipe, but the gauge would not stand within nine pounds of the pressure in the main, which was 12 pounds per square inch.

A separate pipe was run back from the gauge, making a circuit, and the difference of pressure then fell to two pounds.

The great difference at first observed was probably due to a column of condensed water in the vertical part of the dead end.

DEFECTIVE CIRCULATION IN A STEAM-HEATING APPARATUS.

WE learn from Mr. E. E. Magovern of an interesting case of defective circulation in a high-pressure steamheating apparatus located in a large office building.

Steam was brought into the building at a pressure of 60 pounds, and taken to a horizontal steam-main fire inches in diameter in the top of the building, from which 21/2-inch supply-pipes descended to a 4-inch return main in the basement.

Each radiator had a single 3/2-inch connection to the supply-pipe for both steam and return.

One supply-pipe about in the centre of the building had on it but 16 square feet of surface; the others had a much larger quantity-in some cases 300 or 400 square feet

When steam was turned on it pretty much all went through the pipe supplying the least surface, so that the other radiators got little or nothing.

Probably the difficulty could have been remedied by equalizing the amount of surface supplied by the different pipes; but as that could not conveniently be done, the expedient was adopted of putting a trap at the foot of each supply-pipe to return the condensed water into the 4-inch main, which had the desired effect of securing a uniform circulation.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas Light Company
March 24	24.09	19.26	21.11	29.90	27 72	22.20	29.33

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WELDING BY THE ELECTRIC ARC.

A METHOD of welding by electricity, devised by Mr. Nicholas von Benardos, of St. Petersburg, has recently attracted considerable attention on the Continent, and possesses several features which render it quite distinct from the various processes of fusing and reducing by means of the electric current or the electric arc, proposed from time to time by Siemens, Cowles, Elihu Thomson, Wallner, and others.

Mr. von Benardos works directly with the electric arc produced between a carbon pencil as one terminal, and the metal to be treated as the other terminal. This has been suggested and tried before. But the carbon was made the negative pole, as it was feared that otherwise the consumption would be embarrassingly rapid. Hence the metal became the positive pole—that is to say, it became exposed to energetic oxidation-and a great deal of the trouble experienced by other experimenters arose from this circumstance. In the Benardos process, the carbon forms the positive terminal; it is, of course, quickly consumed, but can easily be replaced; on the other hand there is a favorable reducing action going on in the fused metal. The great importance of this modification can easily be tested by changing the poles, when the work soon becomes enveloped in a dense cloud of oxidized products. The intense heat of the arc melts even the most refractory metals almost instantaneously; but the action is purely local, like that of the blow-pipe, and only those parts upon which the arc plays directly are attacked, the adjoining portions undergoing little change; and the fused mass solidifies and cools very quickly. In the Benardos process the material requires little or no preparation. Even a pretty thick layer of oxide will be reduced and drop off, while smaller quantities of oxides unite to form a slag with the sandy clay frequently added as a flux. This slag prevents the oxidation of the metals whilst cooling. No other fluxes are required. The operations can also be carried on under water, although the gases and steam generated cause trouble. One of the chief advantages claimed for the new system appears to be that the arc is brought to the work. Size is hence a question of secondary importance, and unwieldy pieces may be dealt with. A fortunate accident occurred last summer at the emery works of Messrs. Struve, of St. Petersburg, which directed general attention to this process. The works have a vertical boiler with heaters, some of which had become leaky, and the works were practically at a stand-still. The consulting engineer declared that the repairs would be rather expensive, and might occupy three weeks' time. Mr. von Benardos inspected the boiler and offered to repair the heaters that very day. The boiler was put on a truck, taken to his works, treated electrically on the truck and wheeled back, all in three hours. Another case is reported by Professor Ruhlmann. A cast-iron fly-wheel of more than five tons weight had been broken into several pieces whilst being taken down from the truck. The pieces were fused together within a few hours, and the following day the flywheel was in place and at work.

The operation is as follows: The carbon pencil is allowed to touch for a fraction of a second, and is taken off again immediately, so that between the plates and the carbon pencil an arc of a few milimetres length is formed. The iron melts like wax: the molten metal hissing and evaporating distinctly.

The carbon-holder resembles a pair of scissors, and its construction permits of a quick replacement of the carbon pencil. The diameters of these carbons vary greatly. For more delicate work, fine pencils of only one-sixteenth of an inch are required; whilst boiler plates are welded together by means of thick carbon rods of up to 2½ inches in diameter. The carbon is pointed before using it.

One of the most important applications of the new process is for welding plates of all thicknesses. For the very finest sheets of one millimetre and less, the Electro-Hephaestos Company prefer, with commendable impartiality, a modification of the Elihu Thomson process, although their own process is sometimes equally good. But all stronger plates up to several centimetres thickness are subjected to the rrc.

To effect this with ordinary plates the edges are feathered and pressed together. The furrows are filled with little pieces of the same material, and the arc is then applied whilst fresh pieces are added until the furrow is completely filled with the molten mass. The plates are immediately afterwards finished under the hammer. In making iron welds the small pieces for filling are always of wrought

iron. With iron, a flux of clay sand is recommended, with copper, borax, or sal-ammoniac.

If two iron bars are to be joined end to end, the one bar is roughly centered in a lathe, and the other pressed against it; the body of the lathe is connected with the negative pole. A few momentary touches with the carbon will make the two bars stick together sufficiently so that they move as one piece with the lathe. Whilst the lathe is turned slowly, the welding is effected by the addition of material in small quantities at a time. To join two telegraph-wires the ends are bent, a little iron ring is pushed over the hooks, and the whole fused into a sort of button; the resulting joint leaves nothing to be desired as to conductivity and breaking strength, and the whole operation can be accomplished with a few cells, and in two minutes for 4-millimetre wires.

The intense heat of the arc supplies alloys which are hardly known under other circumstances, so that iron and copper, tin, zinc, lead, steel, cast iron and steel, wrought iron and steel, aluminium and platinum, etc., can be united. This promises important progress in the working of metals. Professor Ruhlmann has exhibited specimens of iron plate welded to red copper, iron plated with tin, and iron plated with lead. In such cases there is probably at the junction of two metals a layer of alloy. Chemical manufacturers would be thankful for cheap copper retorts coated inside with platinum, or iron vessels coated with lead. Professor Ruhlmann saw at St. Petersburg a number of copper tubes soldered into a cast-iron plate, and this iron plate coated with copper several millimetres thickness.

If the metals can be joined by the electric arc, they can also be separated by the same means. For instance, holes can be made if the metal is permitted to flow off. To pierce a hole one inch in diameter through two plates of ½-inch thickness takes about four minutes.

Iron and steel undergo little chemical change under this treatment.

The tensile strength tests of electrically-made joints yielded most satisfactory results. Two pieces of rolled charcoal iron, joined electrically, showed a breaking strength of 28.5 kilogrammes per square millimetre (18 tons per square inch), the iron itself giving 32 kilogrammes; the elongation was 9 per cent. In another instance 93 per cent. of the initial tensile strength was observed. A plate riveted electrically rent finally outside the riveting line.

The "Electro-Hephaestos" of St. Petersburg has taken up these inventions, and in Russia the processes have been introduced at the well-known works of Messrs. Struve. For Austria and France, Baron Rothschild has acquired licenses, and works have been started at Creil. A Dresden company is about to create works at Berlin. For further information we refer our readers to an extended and fully illustrated article on the subject in the London Engineering of January 27, taken from the articles of Professor Ruhlmann in the Zeitschrift des Vereins Deutscher Ingenieure, and the Electrotechnische Zeitschrift.

FLAMAND OR "FLEMISH" TUBES.

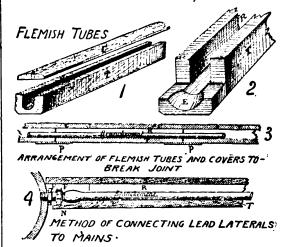
UNDER this title Le Genie Civil describes some of the methods that have been employed in France for the protection of small underground pipes and conduits. It says:

"Since metallic laterals placed underground are exposed to many causes of deterioration, the great extent to which pipes are being laid to day for the distribution of water, gas, and compressed or rarefied air, and as conduits for telegraph, telephone, and other electric wires, forces upon us the importance of giving to these the best possible protection. Gas pipes require more care in laying and maintenance than any of the others.

Cast-iron, wrought-iron, and lead pipes are used for the above purposes. Placed in the subsoil of cities and subjected to the incessant action of moisture, of oxidizing agents, of vibrations, of caving in, of settlement, and of all the movements of the earth due to the passage of vehicles on the surface, and to the excavation and refilling necessitated by the use of the streets, these pipes last for only a comparatively limited period whose duration depends entirely on the more or less efficient protection given them. This deterioration to which they are exposed is to be feared, not only on account of the repairs, or the replacement of the pipe which it causes, but also on account of the leakage which it occasions—leakage always prejudicial and often dangerous.

The use of cast-iron pipes is sensibly diminishing. They can be obtained only in short lengths, which increase the number of joints and consequent leakage, and are more expensive. They are relatively fragile and brittle, and it is difficult to manufacture them of the small diameter required for gas laterals.

Laterals of wrought iron, on the contrary, are much employed. They are strong, easily laid, and keep their shape well. These tubes can be obtained of considerable lengths and the number of joints is thus reduced. It is true, however, that these tubes oxidize very easily and that their destruction by rust is rapid, so that their average durability is but from three to eight years, according to the character of the earth in which they are laid.

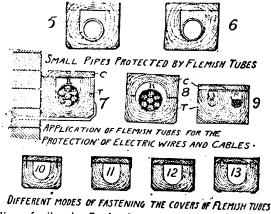


As to lead pipes, which have the advantage of requiring no intermediate joints, of not oxidizing and of being very little influenced by chemical agents, of being laid more easily and more rapidly, and so less expensively, it must be remembered also that their malleability constitutes a drawback to their employment in the subsoil, for they can be deformed, flattened, or broken by pressure or settlement of the earth, or by the stroke of the pick of the laborer.

Various modes of protection have been employed.

For wrought-iron tubes several methods have been used, such as coating by the Bower-Barff process, intended to protect the iron tubes from oxidation or from injury by chemical agents; but these processes are of no avail against physical agents of deterioration and against deformation or rupture.

In order to obtain this latter protection, whatever may be the kind of tubes employed, the laterals are placed in wooden casings of a square or triangular section made of strips of wood coated or impregnated with tar from 12 to 15 mm. thick, nailed together, and with a cover secured by clasps. The space is then filled with melted tar mixed with sawdust or sand. Sometimes for the wooden cases are substituted earthenware or light cast-iron tubes which are filled with an insulating mixture. Mr. Alexandre Léon, ironmaster in the Landes, struck with the resources which the cultivation of timber in this region and in that of the Gironde afford, and with the facilities which the new



lines of railroads offer for its transportation, proposes to substitute for these protecting casings special wooden tubes, to which he has given the name of "Flemish" tubes.

The manufacture of these tubes is conducted at the works of St. Isidore, near Lesparre (Gironde), the forest of Flamand furnishing the wood. New and original forms have been made to insure rigidity of the conduits. Their preservation is secured by the injection of creosote, and rigidity obtained by means of strips placed under the lower joints and by breaking joints between the upper and lower parts when putting together.

The section of these Flemish tubes can be varied according to the use for which they are intended.

As to the covers, they are either nailed on the edges of the tube, or else fixed on by means of hooks or iron wire. Small groves can be made on the surfaces of contact, which are filled with melted pitch when putting on the covers. Tightness, especially for electric cables, is insured by a layer of melted pitch or tar placed on the surfaces of contact.

The advantages of these tubes as protectors are the following:

They prevent injury from shocks and exterior pressure, as well as from settlement of the earth. By reason of their solidity, and of their construction of one piece, they preserve the metal from all oxidation and deformation, and their durability adds greatly to their value; finally they act in the same way as a tight pavement in regard to the leakage of gas, as has been proven by different gas companies that use these tubes, notably the gas company of Bordeaux.

They can also be employed for the protection of electric wires or cables placed in the subsoil instead of the cast-iron tubes now employed.'

DESCRIPTION OF ILLUSTRATIONS.

In Figs. 1 and 2, T is the "Flemish" tube, C the cover, R the groove, and E the recess for the union and solder joint in case lead pipe is used. Figure 4 is a section of the same thing, but showing also the lead lateral in place and its connection to the main. Figure 3 is a section of the continuation of the same lateral and enclosing tube breaking joint with its cover, and resting on splice-plates. Figure 5 is a transverse section of the same arrangement. Figure 6 shows an iron pipe in "Flemish" tube, with groove filled with melted pitch mixed with sand or sawdust. Figure 7 shows a "Flemish" tube enclosing electric cables affixed to the wall of a tunnel, gallery or sewer. Figures 8 and 9 show the same thing underground, Fig.







OTHER MODES OF PROTECTING SMALL PIPES

o being arranged for a double electric conduit. Figures 10. 11. 12, and 13 need no explanation and are of interest mainly as illustrating the superfluous minuteness with which the matter has been treated. In fact, in view of what has been done in the subways of New York, illustrated and described in our issue of January 14, we do not expect that this article will add very much of value to the subject. It is chiefly interesting as showing different methods of doing and describing such work, but in the matter of subways proper—that is, of subterranean conduits large enough to contain sewers, pipes, and wires, and to afford ready access for repairs or replacement-we might very profitably study what the French have done. Figures 14 to 19 show other modes of protecting small pipes. In Fig. 14 the casing is made of boards. In Fig. 15 the pipe is laid on a board and surrounded with puddled clay. In Fig. 16 it is enclosed in an earthenware tube, and in Figs. 17 and 18 the casing of boards is filled with melted pitch. In Fig. 19 the casing is of thin cast iron and filled in the same way.

A BRIDGE ON A YOYAGE.

The iron truss bridge over the Chicago River at Wells Street was, on the 26th inst., successfully floated on scows from that point to Dearborn Street, where it will remain. The structure, denuded of flooring and other wood-work, weighed about ninety tons. The work was done under the personal supervision of Mr. C. L. Strobel, M. Am. Soc. C. E., Consulting Engineer of the Keystone Bridge Company.

A PATENT DECISION.

THE United States Circuit Court for the district of New York, Judge Wheeler, has given a decision in favor of the Babcock & Wilcox Co. against the Pioneer Iron Works for infringement of their patent in building the "Zell" boilers.

STEAM-HEATING FOR DWELLINGS IN 1810 IN CONNECTICUT.

BRIDGEPORT, CONN., March 28, 1888.

SIR: In looking over some papers to-day, I found the inclosed clipping from the Bridgeport Evening Standard of July 27, 1887. It gives an account, as you will see, of what is claimed to be the first job of steam-heating ever done in this country. The work was done in Fairfield, a small town to the south-east of Bridgeport, and knowing that you were interested in all matters of this kind, I thought it would be a good idea to let you know that Connecticut in this, as well as in other things, is always at the top.

Trusting you may find it of interest, I remain,

Respectfully yours,

ALFRED HOPKINS.

The following is the clipping for which we are indebted to Mr. Hopkins:

(From the Bridgeport Standard.)

"In response to a request from those interested in the matter, we reproduce in full the letter on Steam-Heating, an extract from which was recently given in the Standard:
"HARTFORD, Sept. 16th, 1819.
"Roger M. Sherman, Esq., Fairfield:
"DR SIR:—Yours of the 14th Inst. lies before me with the contents noted. You anticipate warming yr Dwelling-House with Steam, and desire of me a particular account of the Machinery necessary to the object. I shall be happy to give you all the information I possess on the subject; but at present decline doing it by writing, under the belief that it would not be done to yr satisfaction or my own; that it would not be done to yr satisfaction or my own; even if accompanied with Diagrams. Could I see you, Sir, I have no doubt it w'd be in my power to give you more information in an hour, than would be possible with the pen, in two or three days. If, however, you have not business to call you hither, and still wish me to give a written description of the Machinery, please to signify it, and it shall be done. It is perhaps proper for me here to state that my object in making the experiment last winter, was, simply, to test the principle, whether Steam can be advantageously used for heating rooms or not, and am satisfied it can, under some if not all circumstances. My Boiler was not of a kind, or set in a manner to show the economy with which the thing may be done—but a boiler. that it would not be done to yr satisfaction or my own conomy with which the thing may be done, -but a boiler afterwards was constructed for a different application of steam, which I think w'd clearly show that it is economical. The most successful experiments with which I am acquainted, have been made in England, within a year or two, and apparently with great approbation. The difference of climate I think should be taken into consideration; may be questioned whether it will answer as well in a climate so cold as ours, as in theirs; my experiments have not been such as to satisfy me entirely of the facts; but should say any desirable temperature may be obtained, and kept up, even in our climate. If I am correct in my position, there cannot be a question but the advantages of using Steam for warming Rooms are so great as to demand its immediate introduction to the exclusion of all other methods. I am Sir Very Respectfully Yours, etc.,

" LORENZO BULL."

By the above letter it will be seen that Mr. Bull had tried the experiment of heating a room by steam the win-ter before the date of this letter, or probably as early as 1818, and that, a year before, successful experiments in the same line had been tried in England. We know that James Watt, the English philosopher, had warmed his own study by steam many years before this date, but the matter had been looked upon as a mere whim and not as of general application or utility. We presume that the above recorded case is the first in this State if not in the country.'

ENGINEERS' CLUB OF ST. LOUIS.

AT the meeting March 21 there were thirty-two mem-Chairman pro tem., William H. Bryan, Secretary. William S. Henry and John B. Myers were elected members. Mr. S. F. Burnet then read a paper on "Cements and Mortar." He gave some practical hints on mixing and using same; also, how specifications should read and tests be made. He exhibited specimens and gave results of tests. Some information on sand, water, and lime was given. The damaging effects of freezing were shown.

The secretary then read a short paper by E. L. Corthell in review of one by Robert Moore on "Interoceanic Ship Transfer," read before the club March 2, 1887. The criticisms of Mr. Moore on the floating pontoon, the wheel load, comparative economy and capacity of carriage were reviewed to show the practicability of the design. Mr. Moore replied at some length, answering the points brought up, which he claimed did not change the material aspect of the problem. Prof. Johnson called attention to some bars of iron which had been broken in a testing machine bars of iron which had been broken in a testing machine after having been strained beyond their elastic limit and then allowed to rest. The results were: After a rest of one day an increase of strength of 16 per cent, was shown; seven days, 22 per cent.; sixteen days, 26 per cent.

Mr. Bruner called attention to a remarkable case of filtering water through an ordinary brick wall. Prof.

filtering water through an ordinary brick wall. Prof. Nipher reported the results of some experiments on leakage of gases through brick walls.

MICHIGAN BRICK AND TILE ASSOCIATION.

At the eighth annual meeting recently held at Lansing, Prof. R. C. Carpenter, of Ann Arbor, read a paper on "Steam-Drying." C. B. Williams, of Bay City, read a paper on "The Dry Clay Process of Brick-Making."

THE MORRIS CANAL BILL APPROVED.

THE bill permitting the Lehigh Valley Railroad, as owners of the Morris Canal, to surrender its charter and thus be freed from its obligation to furnish facilities for transportation while retaining the right to sell its property, and especially its water, has, by the signature of Governor Green, become a law of the State of New Jersey.

It will be interesting to note what use the owners of the canal will make of their newly-acquired privileges.

The general impression appears to be that it gives them a practical monopoly of the sources of domestic watersupply in the northern part of the State.

A SEWERAGE SYSTEM FOR ATLANTA.

ATLANTA, GA., is having plans prepared for a system of sewerage by its City Engineer, Mr. R. M. Clayton, Mr. Rudolph Hering, of New York, being retained as Consulting Engineer.

HARBOR IMPROVEMENTS IN BUENOS AYRES

A DESCRIPTION is given in the Annales des Ponts et Chaussees for January of the plan of harbor improvement at Buenos Ayres so long delayed by political and finan. cial difficulties.

The Argentine Congress has approved Engineer Manero's plans, and voted \$10,000,000 for the construction of a new port, the work on which is already commenced, and will consist first of a canal 100m. (328 feet) wide and 6.4m. (21 feet) deep below low-water level, prolonging the Balisas River for the entrance of large ships; a basin of the same depth will be constructed for vessels remaining but a short time, and four other docks or basins also of the same depth whose quays will have a total length of 8 kilometres (26.2 feet); finally, a maritime basin of equal depth and 1,430m. (4,692 feet) long will be made. All the masonry will be of beton blocks. Separate storehouses will be built for imported and exported goods, which will occupy a total area of 1,000m. (3,280 feet) by 50m. (164 feet), and have a capacity of 315,000 cu. m. (10,963,900 cu. feet). All the quays will be provided with loading and unloading appliances, cranes, and der-

DISINTEGRATION OF BRICKS.

THE atmospheric influences producing disintegration of bricks, tiles, etc., are noted by the *Chronique Industrielle* as being much less active and destructive in a season of continuous humidity than during alternately wet and dry periods. Their action also is obviously affected by the chemical and physical composition of the bricks and their degree of burning. An excess of sand destroys cohesion, and calcareous matter is reduced in burning to lime, which will be slaked by exposure to moisture, and, by the expansion which follows, causes disintegration.

APRIL 10, it is said, has been fixed upon as the date of opening the Union Elevated Road in Brooklyn. The Kings County Road promises to be ready for travel in less than a month.

OBITUARY.

GEORGE F. HARRIS, a prominent railroad contractor, died March 18, at Clayton, Ala., aged 70 years. Thedeceased built the Great Western Railroad of Canada, in 1852, and a few years later invented a track-laying machine. Mr. Harris was at the head of the firm of George F. Harris, Son & Co.

SURGEON WILLIAM C. SPENCER, U. S. A., died at Fort Trumbull, March 22. The deceased was born in 1838, and entered the army in 1861.

PERSONAL.

W. W. OLNEY, C. E., has resigned his position as Principal Assistant Engineer of the Louisville and Nashville Railroad, and is in New York.

CITY ENGINEER SANFORD, of San Diego, Cal., is to visit many of the principal Eastern cities for the purpose of studying the different styles of pavements and street work in general; also the laying out of public parks, etc., with a view of applying his investigations to the interests

DESMOND FITZ GERALD, Superintendent of the Western Division of the Water-Works, has received the "Norman' medal of the American Society of Civil Engineers for the best paper read at a meeting of that body. This is the third time that the medal, which is only given to papers of a high standard of excellence, has been presented to an employee of the Boston City Engineers' Department.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

THE Hydraulic Pressed Brick Co., of St. Louis, Mo., have issued an attractive catalogue illustrating the various products of their logue flustrating the various products of their works, including front bricks, molded and ornamental bricks, arches, and several pages of details of buildings, illustrating various combinations of special shaped brick.

ARCHITECTURAL COMPETITIONS.

TECUMSEH, NEB.—Plans are wanted here for a \$40,000 court-house, until April 3. Address J. L. Young, County Clerk.

Tipton, Ind.—Plans are wanted here for a county ail, to cost \$25,000. No date specified. Address the lipton County Commissioners, as above.

Kingston, Can.—Plans are wanted here for a new diffice for Chalmers Church, to cost \$25,000. No date

New York City.—Prof. Ware and the committee in harge of the architectural competition for plans for the new club-house which the Progress Club will erect it bixty-third Street and Fifth Avenue, have accepted the plans of Alfred Zucker & Co., of this city. The ottal expenditure including land, it is said, will exceed \$500,000 and the work of construction will begin at ince.

St. Paul, Minn.—Competitive plans for the new furner Hall have been considered, and the award has een made to Messrs. Gerloch & Haas.



for works for which proposals are requested see also the "Proposal Column," pages i-v11-v11-272-ix.

Persons who make any use of the information they nd in these columns we trust will not omit to mention the Engineering & Building Record as the source.

Jur readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

EAST LIVERPOOL, O.—The Sewer Commissioners of his city advertise for proposals for the construction f sewers in the Sewer District No. t. Cast-iron rater-pipe, special castings, rings and covers for flush-inks, inspection-pipes, manholes, cement, etc., are ranted. For details see our Proposal Column.

TULLAHOMA, TENN.— Our correspondent writes:
Our water-works company is not yet organized, but it sonly a question of a very short time until something i the kind is done, as better water facilities are an inspensable necessity in our rapidly growing town. The intention now is to organize and charter a private ompany, who will construct and operate the works nder such regulations as our muncipal authorities may reproper to enact."

Mt. Clemens, Mich.—Our correspondent writes: Our City Council have resolved to submit the proposition to the voters at spring election of raising \$50,000 y bonds for construction of water-works. It will probbly carry."

Wotpboro, N. H.—Concerning the water-works enject here, C. J. Frost, the Town Clerk, writes as ollows: "At the annual town meeting held March 7, 1888, it was voted to appoint a committee to make urveys and estimate the cost of establishing a water ystem in Wosfboro, and report at a meeting to be alied on or before May 20."

STAUNTON, ILL.—Concerning the reported water-rocks improvements here our correspondent writes as ollows: "The land has been purchased on which a section is to be built. Work will begin as soon as reather will permit."

BEATRICE, NBB.—We are in receipt of the following ommunication, dated March 20, from the Town Clerk this place: "Filter proposition was carried March 20 by 130 majority for a filter plant of a million galous capacity per day."

OBERLIN, KAN.—It is proposed to establish a system if water-works here. Bonds in the sum of \$30,000 will mobably be issued.

OVID, MICH.—A complete system of water-works is 0 be erected here. For details see our Proposal Col-

GREENPORT, N. Y.—A committee of citizens of this dace who have charge of introducing water have sent petition to the Board of Trustees recommending the franting of a franchise to a company composed of frooklyu capitalists.

Paso Robles, Cal.—The Paso Robles Water Comany has been incorporated here. Capital, \$20,000. M. Shackelford, and others, incorporators.

HUNTINGBURG, IND.—Our correspondent writes: "The Citizens' Gas and Water-Works Company, H. Rothert, President, has been incorporated with a capital of \$25,000. They intend building water-works, eservoir system, the coming summer. The source of supply is 2½ miles distant from the proposed reservoir, which is to be constructed on a hill just west of the ity."

ORLEANS, NEB.—Charles S. Simpson, Town Clerk, writes us: "We are contemplating putting in of waterworks and are awaiting plans and propositions from those who wish to take contract."

BUTTE, MONT. T.—A despatch to the San Francisco Chronicle says the City Council passed a resolution condemning the water-supply to the city by the S.lver Bow Water Company as impure and unfit for domestic use, and inviting proposals for furnishing a sufficient supply of good, pure, wholesome water at a reasonable rate. The Council agr esto give an exclusive franchise to any company which will relieve the present situation. County Physician Hoigh in a report to the Council upon the quality of the water furnished to the city, pronounced it "dangerous and damnable."

WATKINS, N. Y.—The committee appointed at a public meeting held several weeks ago to procure estimates and surveys for a system of water-works for this piace, called a meeting of taxpayers and others March 24, at which the report submitted by Mr. C. P. Bassett, C. E., of Newark, N. J., was considered The report estimated the cost of the water-works at \$48,000 and sewers \$22,000. After reading the proposed law which should be introduced in the Leeislature a vote was taken to send it to Albany for passage at once. The following are the commissioners named in the bill: Hon. Daniel Beach, F. Davis, Jr., and others.

Hon. Daniel Beach, F. Davis, Jr., and others.

WEST TROY, N. Y.—The Albany Journal says:

"The West Troy Water-Wo ks Company's plant has been purchased by the Green Island Water Company. The Green Island Company consists of Messrs. Moffet, Hodgkins & Clarke of Watertown. Their contract now gives them power to pump from their plant to be erected on the island through the mains of the West Troy Water Company. The main office of the company will be in Green Island. Gravei Island will be used for the filtering process and the pumping station will be in Green Island.

HALSTEAD, KAN.—It is reported that a system of water-works is contemplated for this place and that Mayor S. H. Tuco can furnish details.

GLOURRSVILLE, N. Y.—Our correspondent writes:
"We have decided to extend our present system (gravity) by the construction of a conduit about 7 miles in length to new source of supply, together with intake basins and smail reservoir, at an estimated cost of about \$100,000. No engineer engaged yet; expect to begin work as soon as weather will admit."

DETROIT, MICH.—The Sewer Committee of the Common Council has fixed the amount to be raised by bonds and otherwise, for constructing additional sewers, at \$282,446.75.

JERSKY CITY, N. J.—The date for receiving bids for new water-supply and for the filtration of the pres-nt supply has been changed from April 21 to April 9.

PARIS, Kv.—Our correspondent writes: "The contract for water-works has been let to W.E. Thompson, of Bradford, Penn, subject to ratification of voters of city. Election will be held April 14. It is the genera opinion it will be ratified."

MILFORD, N. H.—Our correspondent writes: "The town voted to accept and adopt a resolution instructing the Selectmen to invite proposals from more than one corporation or party for putting in water-works in this town and to make a thorough examination of the subject, get all the information possible by visiting other towns who had a system, and employ experts, and in such oth r ways as they may deem best before concluding a contract, and that said contract shall be concluded within 90 days."

CAMDRN, ARK.—The President of the Camden Water-Works Co. writes us: "We have filed articles of association. Authorized capital, \$10,000; subscribed capital, \$10,000. There is some detail work to be done yet before we can close contract for construction, such as obtaining privileges from the city, etc., etc. We contemplate commencing the construction not later than May next and hope to have same completed by August 1. We want estimates on 4,000 feet 8-inch main pipping, 2,000 feet side pipes, either 2 or 3 inch and fixtures, 18 fire-plugs and all necessary equipment to make a first-class system for a small city of 2,500 people. We want pump and main capacity sufficient to supply 10,000 people. We are not certain but that we will use 10-inch piping. Distance from low-water mark at pumphouse to highest point in the city 4,000 feet; difference in altitude 115 to 120 feet. Want a stream thrown perpendicular from point above mentioned 100 feet, by pressure direct from the pump. We want an estimate based upon first-class machinery and the latest and best machinery. Do not want anything shoddy, believing the best is the cheapest."

CAMDEN, N. J.—Among the improvements which are to be made to the water-works here will be the addition of a new stand-pipe, of iron, 89 feet in height, and 130 feet above tide-water. Bids will soon be wanted.

CENTRAL CITY, Ky.— Our correspondent writes; "The water-works have not yet materialized, though there is quite a lot of talk about building them this coming summer. A charter has been secured. Can't tell whether they will or not be built this year."

WATER-WORKS.—See our Proposal Column for information regarding water-works and water-works supplies at the following places: Cambridge, O.; East Liverpool, O.; Ovid, Mich.; Jackson, Miss.; Dover, N. H.; Newark, N. J.; New York City.

Nиоsно, Mo.—It is reported that water-works are ranted here and that J. E. Alexander can furnish

BRIDGES.

OTTAWA, CAN.—Application has been made for a charter to construct a bridge from Windsor or Sandwich to Detroit. The capital stock of the company, which is to be known as the Detroit River Winter Railway Bridge Company, is placed at \$500,000.

HERSEY, MICH.—An iron bridge is to be built by the County Commissioners.

BIG RAPIDS, MICH. — The County Commissioners have decided to place a bridge over the Muskegon River at this place. Address them for details.

ST. PAUL, MINN. — Our correspondent writes: "The Wabasha Street bridge across the Mississippi is to be enlarged at a considerable expense. Bids will be required."

Memphis.—A letter published in the Memphis Appeal has been addressed to Mr. D. P. Hadden, President of the Taxing Districts of Memphis, Tenn., by Mr. W. R. Harvey, a railroad contractor and bridge builder of that city, strongly urging that such additions be made to the contemplated double-track railway bridge over the Missis-ippi at that point, as will accommodate street-car and wagon traffic and foot passengers. The bridge is to be built by the Phemix Bridge Co., and a letter is enclosed from Mr. A. Bonzan, its Vice-President and Chief Engineer, stating that the proposed additions to the bridge and approaches be easily made at a cost of about \$475,000.

LEAVENWORTH, KAN.—County Clerk J. W. Niehaus wants bids for the construction of two bridges. See our Proposal Column.

Winston, N. C.—It is reported that the County Commissioners will build an iron bridge over Salem Creek, in Forsyth County. Address, for details, E. A. Conrad, at this place.

CAPE MAY CITY.—The Board of Freeholders of ape May County has ordered a new bridge erected wer Cape May Creek, between this city and West

Cape May.

NEWARK, N. J.—The Special Committee of the Essex County Board of Freeholders to examine into the necessity of a new bridge over the Passaic to connect the Twellth Ward of Newark and the town of Harristn, held a meeting March 28 and discussed the question of the exact location of the structure. At a meeting to be held next week it is expected that definite action will be taken, and steps toward surveys, etc., will be made.

Bridge.—See our Proposal Column for information regarding bridge construction at the following places: Lynchburg, Va.; Leavenworth, Kan.

RAILROADS, CANALS, ETC.

PITTSBURG, PA.—It is reported that the Pennsylvania Railroad management has decided to commence work on the projected improvements at Wals Station during the coming spring. Bids for the commencement of the work are being received by Chief Engineer Brown, at Philadelphia. The estimated cost of the work is \$1,000,000 and it is thought that it will take at least five years to complete the enterprise.

SING SING, N.Y.—The Ossining Railroad Company has organized to construct a road from this place to Whitson's Station. John V. Cockcroft is one of the directors.

New Brunswick, N. J.—A dispatch to the World says: The directors of the new karitan River Railroad heid a meeting in the Fuller Building, Jersey City, March 22, during which it was decided to begin building the road without delay between South Amboy and this city and Bound Brook. Contracts for iron and building were entered into with John Buttman and the Scranton Steel Company. The road will measure twenty miles and be bonded for \$30,000 per mile.

STREET-WORK AND PAVING.

Kansas City, Mo.—It is estimated that \$500,000 will be expended on street improvements here this

TOPPKA, KAN.—Estimates are being made by City Engineer for several thousand dollars' worth pavements to be laid during the present season.

GAS AND ELECTRIC-LIGHTING.

Annapolis, Md.—The Annapolis Electric Company has been incorporated here. Capital, \$100,000. George Wells, and others, incorporators.

MALDEN, MASS.—The Malden Electric Company has been incorporated here. Capital, \$20,000. John S. Bartlett, and others, incorporators.

Jackson, Mich.—At a recent meeting of the stockholders of the National Water, Gas and Fuel Company at Chicago the plant located in this city a year ago was decided upon as the most available place for the construction of model works for showing how gas can be made and used for domestic purposes. C. H. Evans, manager of the company, states that the work of constructing the new plant is under way, and that the company will make improvements to amount to \$250,000.

WEST SPRINGFIELD, MASS.—The Agawam Gas Company has been incorporated here, with J. R. Smith and others interested. Cash capita, \$50,000.

QUINCY, MASS.—The Quincy Electric Light and Power Company has been organized here, with a cash capital of \$25,000. G. A. Pattee is one of the directors.

WINCHESTER, MASS. - The Winchester Electric Light Company has been organized here, with a cash capital of \$10,000. James F. Dwinnell is at its head.

POMEROY, O.—It is reported that this place is to be ighted with electricity.

St. Johnsbury, Vt.—A company has been formed here with a capital of \$20,000 to establish an electric-light plant.

OBERLIN, KAN.—An electric-light plant is to be established here this spring.

MONTICELLO, ILL.—An electric-light system is to be established here. DULUIH, MINN.—The gas and water company will erect new and larger gas-works.

BIDS OPENED.

BIDS OPENED.

Newport, R. I.—Only one bid was submitted for laying about 3,800 square vards of asphalt pavement, opened March 23 by the Street Commissioners. The following was the bid: Henry Bolze, New York, \$2.75 per square yard.

The following bids for excavating about 1,600 feet of tunnel were opened March 23 by the Street Commissioners: Price per linear foot. John Waters, Newport, R. I., tunnel, \$2.52 shafts, \$2.50 each; Michael F. Murphy, Newport, R. I., tunnel, \$8.92; shafts, \$250 each; Michael F. Murphy, Newport, R. I., tunnel, \$8.00; shafts, \$12; Whittaker & Wright, Worcester, Mass, tunnel, \$12; shafts, \$12; Whittaker & Wright, Worcester, Mass, tunnel, \$14; shafts, \$10; Shaw & Whittiesey, Providence, R. I., tunnel, \$17, 43, including shafts; J. W. Douglass, Newburyport, Mass, tunnel, \$10,00; shafts, \$13; Charles Hart & Son, Brooklyn, N. Y., tunnel, \$11; Kittridge & Hale, Lowell, Mass., tunnel, \$16,35; shafts, \$12.10 and \$13.50; Boynton Bros, Boston, Mass., tunnel, \$12.00 and \$13.50; Boynton Bros, Boston, Mass., tunnel, \$15,00; shafts, \$12.10 and \$13.50; Boynton Bros, Boston, Mass., tunnel, \$15,00; shafts, \$10.50. The contract has not as yet been awarded.

Grand Rapids, Mich.—All bids submitted for fur-

Grand Rapins, Mich.—Al! bids submitted for furnishing a new boiler for the water-works being unsatisfactory new proposals are solicited for March 31.

isfactory new proposals are solicited for March 31.

ALTOONA, PA.—WATER-WORKS MATERIAL.—The following bids were submitted for furnishing cast-iron water-pipe for the water department, opened March 20 by the Water Commiss oners: McNeal Pipe and Foundry Co., Burlington, N. J., 12 inch, per ton, \$20,50: 4 inch, \$31.75; R. D. Wood & Co., Philadelphia, 12 inch, \$27.88; 4 inch, \$29.80; National Foundry and Pipe Works, Scottsdale, Pa., 4 inch, \$28.70; Jorn J. Fisher, Allentown, Pa., 4 inch, \$29.85; Addyston Pipe and Steel Co., Cincinnati, O., 12 inch, \$31; 4 inch, \$32. Jackson & Woodin Mfg. Co., Berwick, Pa., 12 inch, \$32.50; 4 inch, \$37.50; C. W. & H. W. Middleton, Philadelphia, Pa., 12 inch, \$29.82; 4 inch, \$31 35; Mellert Foundry and Machine Co., Reading, Pa., 12 inch, \$28.40; 4 inch, \$30.

\$28.40; 4 inch, \$30.

Boston, Mass.—The City Architect has received the following proposals for 2,000 piles for the new public library building: Price per pile for excavating and driving: P. O'Riordan, \$4.63; George N. Cavanaugh, \$4.25; John J. Scully, \$3.25; Horace Sias, \$4.97. For additional piles, each O'Riordan, \$3.63; Cavanaugh, \$4.25; Scully, \$3.24; Sias, \$4.96. Price per yard for additional excavation: O'Riordan, 20 cents; Cavanaugh, 40 cents; Scully, 22 c-nts; Sias, 50 cents. Allowance for piles not used: O'Riordan, \$3.63; Cavanaugh, \$2.80; Scully, \$2.86; Sias, \$3.50.

Boston Mass.—Graver, Filling.—The Park De-

Boston, Mass.—Gravel Filling.—The Park Department received the following bids for furnishing 45,000 cubic yards of gravel filling for the Back Bay Fens; Augustus Saucier and Neil McBride, \$1.69 per cubic yard; Thomas F. Meany & Co., 90 cents; Boston and Albany Railroad Co., 57 cents. Awarded to B & A. R. R. Co.

A. R. R. Co.

BOSTON, MASS.—PAVING, ETC.—The Superintendent of Sewers has received the following proposals for 650 tons rubble stone, 8,000 paving clocks, and 220 cubic vards dimension stone: S.&R. J. Lomband, stone per ton \$2.87, blocks each 21C. dimension stone cubic yard \$12; Thomas A. Rowe, rubble stone \$4, blocks 22C. dimension stone \$16.60; Edward C. Munson, rubble stone \$4.50, blocks 27C. dimension stone \$16.50; James J. Vernon, rubble stone \$3.26, blocks 27C. dimension stone \$15.25; Shields & Carroll, rubble stone \$3.24, blocks 15C., dimension stone \$15.25; Shields & Carroll, rubble stone \$3.24, blocks 15C., dimension stone \$12.37. The contract was awarded to S. & R. J. Lombard.

TRENTON, N. J.—SEWERS,—The following were the lowest bidders for sewer construction in Sewer Districts Nos. 1, 2, 3, 4 and 5, b.ds opened March 20, by the Sanitary Committee of the Common Council: District No. 1, D. Lodor, Trenton, N. J., \$13,010.95; No. 2, P. J. Condon, \$15,85,35; No. 5, Condon, \$5,182.—9.; No. 4, Condon, \$15,85,35; No. 5, Condon, \$\$96,20. The following is the combined bids of those who put in proposals for the entire work:

P. J. Condon, Jersey City, N. J., \$37,949 25.

B. M. & J. F. Shanley, Jersey City, N. J., \$42,-

o76.51.

Daniel Lodor, Trenton, N. J., \$45,036.30.
Crawford & Rooney, Paterson, N. J., \$46,319.25.
Ard Bros., Jersey City, N. J., \$52,266.70.
Wilham H. Achuff, Philadelphia, Pa., \$61,026.41.
Thomas Craig, Trenton, N. J., \$61,827.08.
Deehan, \$30,024.
It was agreed that the committee recommend to Common Council that the contract for construcing the main intercepting sewer be awarded to Daniel Lodor, and the contract for the other two sewers and the two drains to Patrick J. Condon.

BOSTON Mass.—Paurice, Brogge, The Both Daniel Col.

BOSTON, MASS.—PAVING BLOCKS.—The Park Department has awarded to S. & R. J. Lombard the contract for furuishing 100,000 paving blocks at \$48 per ton. The only other bidder was Thomas A. Rowe, whose bid was \$55.

MNOSE DIM WAS \$955.

DENVER, COL.—But one bid was received by City Engineer Harvey C. Lowrie, March 19, for sewer construction in the Thirty-first and Lenth Street Sewer Districts, the pay being in special tax bills, the proposed issue of which is said to be antagorized by city financiers consequent upon the successful contesting of the collection of a former issue upon a legal technicality.

BOSTON, MASS.—MASON WORK.—The following proposals have been received for furnishing all labor and materials for mason work in the Horace Mann schoolhouse: Edward Lynch, \$22,245; R. R. Mayers & Co., \$25,270; Keening & Strout Bros., \$25,856; Charles H. Dodge, \$27,905; Donahue Bros., \$24,800. Contract awarded to Mr. Lynch.

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ALBANY, N. Y.—The following bids for rebuilding about 200 lineal feet of vertical wall in cement were about 290 lineal feet of vertical wait in Grincus west opened March 27 by James Shanahan, Superintendent of Public Works: John F. Clark, Fort Edward, N. Y., \$2,373.75; Swan & Reily, Glens Falls, N. Y., \$2,209. The contract was awarded to Swan & Reily.

The contract was awarded to Swan & Reily.

Welland, Dntario.—The following bids for fursishing two duplex power pumps, one of 1,500,000 gallous pumping capacity and one of 750,000 gallons; also for about 270 gross tons of 8, 6, 5 and 3 inch cast-iron pipe, were opened March 27 by John F. Gross, Secretary Water-Works Commission:

For pumps—Volker & Felthousen, Buffalo, N. Y., 1,500,000-gallon pump, \$1,300 and \$1,560; 750,000 gallons, \$010 and \$1,002. Charles Smith & Co., Toronto, 1,500,000-gallon pump, \$200; 750,000-gallon pump, \$725. Northy & Co., Toronto, for both, \$4,600. N. Kennedy & Sons, Owen Sound, for both, \$4,600. Holly Manufacturing Co., Lockport, N. Y., for both, \$3,550. J. W. Ronald, Brussels, for both, \$5,000.

For pupe—Le Valle & Co., Montreal, \$28 gross ton:

For pipe—Le Valle & Co., Montreal, \$38 gross ton; I. Quenkull & Co., Montreal, \$39.50 per gross ton; William McNally & Co., Montreal, \$41.20; St. Lawrence Pipe Foundry, Toronto, \$42
The contract for pumps was awarded to N. Kennedy & Sons and for pipe to Le Valle & Co.

NEW YORK CITY.—At a meeting of the Armory Commissioners held March 29, bids for the construction of the new armory for the Twenty-Second Regiment were opened. As the total of the lowest bids amounted to \$45,972 over the amount appropriated (\$300,000) the contracts were not awarded.

CLEVELAND, O.—The following bids for tunnel under Lake Erie were received by John Whitelaw,

water-	Works Superintendent,	March 24:
	Stanley Bros. & Co., Cleveland, O	Bidders.
	\$27.50 35.00 22.00 25.41 21.00 26.25 18.00 24.95	Tunnel. Per foot.
* Award	\$5,800.00 8,500.00 8,408.50 14,295.00 13,839.00 13,839.00	Inlet shaft.
* Awarded contract.	\$27,50 \$9,800.00 \$3,800.00 \$35,000.00 \$35,000.00 \$35,000.00 \$3,800.00 \$25,41 8,400.50 \$3,800.00 \$25,41 8,400.50 \$3,800.00 \$25,41 8,400.50 \$3,800.00 \$25,425 10,800.00 \$6,500.00 \$6,500.00 \$26,25 10,800.00 \$6,500.00 \$6,500.00 \$4,000.00 \$4,000.00	First working shaft.
		Second working shaft,
	\$3,800.00 \$4,800.00 \$4,800.00 \$48.00 7,000.00 10,000.00 10,000.00 150.00 3,200.00 3,000.00 4,300.00 35.00 3,150.00 4,080.00 4,300.00 150.00 5,000.00 5,000.00 5,334.00 250.00 5,005.13 64,47.31 6,947.65,100.00 4,000.00 4,000.00 4,000.00 30.00	Gate Shaft.
	\$4.800.00 \$48.00 10,000.00 \$0.00 3.000.00 \$0.00 4,700.00 \$0.00 5,354.00 \$0.00 6,447.65 \$00.00 4,000.00 \$0.00	Extension Shaft.
	\$48.00 \$0.00 \$0.00 32.50 150.00 250.00 30.00	Extra depth of shaft. Per toot.
	\$280,048.00 372,550.00 223,450.00 257,021.00 230,147.00 274,758.00 2304,701.1f 255,570.00 220,000.00	Total

ST. PAUL, MINN. -- Contract for administration building, city and county hospital, has been awarded to F. J. Romer for \$48,000.

NEW YORK CITY.—The following bids for plumbing two water-closet towers at Bellevue Hospital were opened March 27 by the Commissioners of the Department of Charties and Correction: James Armstron, \$1,659; John Spence, \$1,669; F. Callahan, \$2,035; C. Nally, \$2,105; James Moore, \$2,350; George Cody. \$2,750; P. Carraher, Jr., \$3,82. The contract was awarded to the lowest bidder.

warded to the lowest bidder.

New York City.—The following bids were received by the Commissioners of the Department of Docks, and opened March 28, for removing all that part of the old pier at the foot of Fifty-first Street, North River, which lies westerly of a line fifty feet west of the new bulkhead line, and preparing for and building a new wooden pier at the foot of Fifty-first Street, North River: J. W. Flaherty, \$27,075; John Gillies, \$27,500; Richard Cronin. \$25,070; Joseph Walsh, \$28,000; P. Sanford Ross, \$27,100; O'Connell & Coffey, \$31,090; J. H. Staats, \$26,440.

GOVERNMENT WORK.

GOVERNMENT WORK.

TOMPKINSVILLE, N. Y.—Abstract of bids received by Major D. P. Heap, U. S. Army, Engineer Third L. H. D strict, March 24, for building engine and boiler-house at Bedloe's Island, New York: Erasmus D. Garnsey & Bro., New York City, \$13,-685; Linus Seely, Deering, Me., \$13,675; F. H. Smith, New York City, \$12,400; Thomas Farrelly, West Brighton, N. Y., \$12,200,75; James Thompson, Rosebank, N. Y., \$10,400; Philip Wolff & Son, Stapleton, N. Y., \$10,400; Philip Wolff & Son, Stapleton, N. Y., \$70,-434; Robert Moore, West New Brighton, N. Y., \$9,75; Philip J. McGuire & Co., New York City, \$9,700; James H. Coster, Baltimore, Md., \$0,500; Colin McLean, New York City, \$9,200; Charles Diem, Albion, N. Y., \$8,804.07.

WASHINGTON, D. C.—The following bids for the supply at the Navy Yard, Washington, D. C., of five boilers of the Babcock & Wilcox pattern, were opened March 27 by James Fulton, Paymaster-General U. S. Navy: Babcock & Wilcox Co., New York, \$2,806; James P. Witherow, Pittsburg, Pa., \$16,800, or four boilers. \$16,550; Edward J. Moore, Philadelphia, Pa., \$20,000; George M. Newhall, Philadelphia, Pa., \$16,500; Abendroth & Root Manufacturing Co., New York, \$19,270. The three last named bids were informal.

WASHINGTON, D. C.—Synopsis of bids for Life Saving Station on coast of Long Island, opened March 21 by S. J. Kimball, General Superintendent, U. S. Life Saving Service: F. H. Smith, New York, \$5,830; R. A. Robbins, New York, \$5,480; J. H. Coster, Baltimore, \$5,993; Morris Jacob, \$7,650; H. A. Talbert, Barnegat, \$5,730.

LITTLE ROCK, ARK.—The contract for the construction of a sewerage system for the Little Rock Barracks was awarded March 23, by W. A. Simpson, First Lieutenant, Second Artillery, A. A. Q. M., to Davey Cloweh, of Little Rock, for \$3,704.

New York City.—The following was the only bid submitted March 29 for deepening the channel in Sheepshead Bay, opened by G. L. Gillespie, Lieut.—Col. of Engineers. The engineer's estimate called for about 18.000 cubic feet of dredging. Bidder, Michael H. Flannery, 50 cents per cubic foot.

MISCELLANEOUS.

ALLENTOWN, PA.—The Allentown Steam Heating and Power Company has been incorporated with a cash capital of \$50.000. James P. Baures, and others, are the incorporators.

WASHINGTON, D. C.—Press reports say that the Supervising Architect of the Treasury suggests that Congress appropriate \$200,000 for the preservation and repair of public buildings generally and appropriate specifically the following sums for the cities named:
Boston, \$28,000; Chicago, \$112,000; Cincinnati, \$64,000; New Orleans, \$169,099; New York, \$267,823; Philadelphia, \$134,608; San Francisco, \$40,000; St. Louis, \$64,1266. He adds, the reports state, that in case it is necessary to extend the Court-House and Post-Office in New York, additional land will have to be purchased, and for this purpose an additional appropriation of \$170,000 will be required.

Westungton, D. C.—The Sanata Committee on

propriation of \$170,000 will be required.

Washington, D. C.—The Senate Committee on Commerce has reported a bill to provide for the erection of numerous lighthouses on Lakes Superior, Huron, Erie, and Michigan. Following are some of the fog signals and lights provided for: Fog signal, Beaver Island, Lake Michigan, \$5,500; Mackinae Point, \$5,500; lighthouse, White Shoal, Lake Michigan, \$60,000; fog signal, Twin River Point, Lake Michigan, \$5,500; fog whistle, Lapointe, Ashland Harbor, Lake Superior, \$5,500; Point Iroquois, \$5,500; fog signal at Two Harbors, \$5,500; light on Devil's Island, Apostle group, \$15,000; range lights at Duluth, \$3,284.12.

The Nam Volt and Nam Lerson Power Company has

The New York and New Jersey Power Company has been incorporated, with a capital of \$3,000,000, for the purpose of manulacturing, seiling, and renting boilers and machinery for obtaining power and heat and tefrigeration under various letters patent. The Trustees are David Dunham Withers, J. Coleman Drayton, John G. McCullough, and others. The principal office is in New York.

PROPOSALS.

(Continued from page viii.

To Builders and Contractors.

PROPOSALS are wanted at Sayre, Bradford Co., Pa., until April 20, for the erection of a stone church and rectory. Plans and specifications may be seen at the Rectory, Sayre, and at the office of the architect, C. M. BURNS, JR., 717 Walnut Street, Philadelphia.

SAND.—Proposals are wanted at New York City, until April 11, tor furnishing 1,200 cubic yards of clean, sharp Cow Eay sand, suitable for road surfacing Address the Department of Public Works, as above.

CHURCH.—Proposals are wanted at Altoona, Pa., until April 7, for the erection of a brick church. Address G. W. Buck, President Trustees United Brethren Church, as above.

NORTH BILLERICA, MASS.—School bldg; cost \$15,000; o, M C Mitchell; a, J L Faxon, Boston; b, John H Fuller and Mr Green. The former does the stone work, and the latter the wood work.

NORTH ADAMS, MASS,—3-story br bldg, 1 story to be used as hall, other stories for tenements; 0, S P Thayer.

FI.AGGING.—Proposals are wanted at Brooklyn, N. Y., until April 2. for flagging certain streets. Address John P. Adams, Commissioner of the Department of City Works.

BUILDING.—Proposals are wanted at Wichita, Kan, no date specified, for the erection of a temple to cost \$100,000. Address the Secretary of the Masonic Fraternity.

SOLDIERS' HOME.—Proposals are wanted at Minnehaha, Minn, until April 24, for the erection of buildings for the Soldiers' Home. Address O. M. Sawyer, Sectetary Minnesota Soldiers' Home.

SEWERS. — Proposals are wanted at Bridgeport Conn., until April 12, for the construction of sewers in certain streets Bernard Keating, Clerk, Board of Public Works, as above.

TAPPING-COCKS.—Proposals are wanted at New York City, until April 11, for furnishing tapping-cocks and tapping cock boxes. Address the Department of Public Works, as above.

GRAVEL.—Proposals are wanted at New York City, until April 11, for furnishing 2,200 cubic yards of Roa Hook gravel suitable for road surfacing; also, 3,000 cubic yards of Roa Hook gravel bank screenings. Address the Department of Public Works, as above.

STOP-COCKS, HYDRANTS, ETC.—Proposals are wanted at New York City, until April 10, for furnishing and delivering stop-cocks, hydrants, wooden hydrant-boxes, and cast-iron stop-cock boxes. Address the Department of Public Works, as above.

PROPOSALS.

WATER-PIPE, ETC.—Proposals are wanted at New York City, until April 11, for furnishing cast-iron water-pipes, bianch-pipes, and special castings. Ad-dress the Department of Public Works, as above.

ENGINES.—Proposals are wanted at Washington, D. C., until April to, for five Armington and Sim's engines for the Navy Yard. Address James Fulton, Paymaster General, U. S. N., Navy Department.

LAYING WATER-MAINS.-Proposals are wanted at New York City, until April 11. for laying water-mains in Morris, Anthony, and Fifth Avenues, and in Ash, Berry, Bush, Buckhout, Twenty-second and One Hundred and Seventy-seventh Streets. Address the Department of Public Works, as above.

BRIDGE.—Proposals are wanted at Hamilton, O., until April 5, for the construction of an iron bridge over the Miami River, at Poasttown. Address the Butler County Commissioners, as above.

LIGHTING .- Proposals are wanted at Washington, D. C., until April 13, for manufacturing and placing in position, in complete working order, in the U.S. bnildings at Syracuse, N. Y.; Lynchburg, Va.; Council Bluffs, lowa, and Waco, Tex., certain combination gas and electric-light fixtures. Address C. S. Fairchild, Secretary of the Treasury.

For additional proposal notices see page ix.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; b s dwell, brown-stone dwelling; afart house, apar nent-house test, tenement; e, each e, owner; a, architect; b, builder; fr, frame.

A CORRECTION.

Boston.—Causeway, cor Portland, br mercantile bldg; cost, \$50,000; o, Brighton Estate; a, Peabody & Stearns; b, E Mason & Co. The above item, which appeared in our last issue, was erroneous and is corrected as follows: Causeway, cor Portland, br mercantile bldg; cost, about \$100,000; o, Brighton Estate; a, Hartwell & Richardson; D Connery & Co. and Leander Greely are the contractors.

NEW YORK.

9-11 Norfolk st, 1 brick workshop; cost, \$15,000; o Chas Schmidt; a, Fred Ebeling. 58th st, s s, 200 e 9th av. 4 br dws; cost, \$14,500 each; o, Knapp & Frisbie; a, M V B Ferdon.

58th st, s s, 264 e 9th av, 2 br dws; cost, \$16,000 each; o and a, same as above.

Av A, se cor 77th st, 2 br and s flats; cost, \$48,000 all; o, Harry Muldoon; a, G B Pelham. 75th st, n w cor toth av, r br stable; cost, \$45,000; o, W F Walton; a, C A French & Co.

88th st, n s, 250 w 8th av, 5 b a dws; cost, \$20,000 each; o, Ryan & Rawnsley; a, Thom and Wilson.

124 E 126th st, 1 brick and b s flat; cost, \$20,000; o, Adolph Brussel; a, Buchman & Deisler.

3d av, n e cor 140th st, 1 brick ten with store; cost, \$17,500; o, Henry Behrman, Brooklyn; a, A. Pfeisfer.
3d av, w s, abt 100 n 167th st, 1 brick flat with store; cost, \$10,000, o, John Bauer; a, Adolph Pfeisfer.

S s 113th st, 100 w 5th ave, 4 br dws; cost, \$60,000; o, Wm C Burne; a, J C Burne 311-13 Av A, 2 br dws; total cost, \$34,000; o, Chas H Reed; a, Rentz & Lang

1664 9th av, br apart house; cost, \$12,000; o, John Schuback: a, J F Burrows

Ne cor 31st st and Broadway, br office bldg; cost, \$00,000; o, D A Loring; a, Lainb & Rich
110 Division st, br ten; cost, \$13,000; o, Frederick
Schusschardt; a, Renwick, Aspinwall & Russell

548-50 W 23d st. br factory; cost, \$36,000; o, Fowler Mfg Co; a, Geo B Pelham Ne cor 130th st and Willis av. br store and flats; cost. \$18,000; o, Frederick Freudenthal; a, John G. Mich-

Es Willis ave, 23 n 139th st, br store and flats; cost, \$12,000; o and a, same as above

BUILDING INTELLIGENCE.

NEW YORK CITY-Continued.

50-52 Lawrence st, 2 br dws; total cost, \$32 00: Peter retreno and Con Link; a, Angrew Spence S s 121st st, 250 w 7th av, br dw; cost, \$15,00; Mary E Carlin; a, Chas P H Gilbert

Se cor roth av. and ooth st, br ten; cost, \$25,000. John & N Cotter; a. John C Burne

Se roth av, 25 s 99th st, br ten; cost, \$18,000; can a. same as above Sw cor 7th av and 37th st. br store and tet; c.s. 20,000; o, Anna R Morison; a, Thom & Wilson

S w cor 20th st and 5th av, bi bldg; cost, \$50,000 Methodist Book Concern; a, Ed H Kendall Foot of 32d st, N R, freight shed; cost, \$40.000 N Y, C & H R R R Co., Walter Katte, Chief ket

ALTERATIONS-NEW YORK

333-35 E 132d st, br bldg; cost, \$7,000; 0, John K-a, Wm Sinciair 123-25 E 52d st, br bldg; cost, \$7,000; 0, R MG-ham; a, H B]ohes

135 E 42d st, br hospital; cost, \$20,000; 0, New York Hospital for the Ruptured and Cripplet; a, A beland.

Foot of E 26th st, Bellevue Hospital; cost, fra: 6th St. Commissioners of Charities; a, Withers & Lab

32 E 37th st, br bldg; cost, \$30,000; o, Sarah Aliu

36 E 14th st, br store; cost, \$10,000; 0, Henry 1/2 lard; a, Jas E Ware.

N e cor 5th av and 31st st, br store; cost, \$25.000 Wm Moir; a, Chas B Atwood.

BROOKLYN.

s Heywood st, 80 w Lee av, 2 br dwells; cos, i-all; o, M Brunner; a, Hillenbrand

S e cor Flatbush av and Prospect pl, 3 dwelltards: cost, \$45,000 all; o and a, F Keith Irving. E s Flatbush av 133 s Prospect pl. 2 dwells and se cost, \$30,000 all; o and a, same as above.

S s Prospect pl 123 w Flatbush av, 2 dwell and st cost, \$30,000 all; 0 and a, same as above.

S e cor Flatbush av and Prospect pl, dwell aid cost, \$25,000; 0 and a, same as above.

E s Gunther pl 86 s Herkimer st, 3 dwells; cos. \$4.000 all; o, R D Robbins; a, Remson.

Sw cor Central av and Linden et, 5 frdwellsact; cost, \$22,500 all; o, John Rucger; a, J Erich. Es Hicks st, 250 s Rapelyea st, 2 br dwells and sz, cost, \$12,000; O, Mary E Lynch; a, not given.

Ws Rockaway av, 86 s Herkimer st, 3 br fair set stores; cost, \$18,000 all; o, R D Robbins; a, J ker-

W s Schenck st, 195 n Lafayette av, 4 br dws ass. \$34,000 all; o, Thos H Brush; a, J G Glover.

Es Driggs st, 80 s Grand, br store; cost, \$1000°. EB Tuttle; a, WH Gayler. Es Carleton av, 90 ft s Myrtle av, br stable: cs \$20,000; 0, H Feuchteuanger; a, M J Mornil.

N e cor 20th st and 9th av, br railroad deprior. \$21,000; 0, Prospect Park and Coney Island R R A Mercein Thomas.

386 Jay st, br flats: cost, \$9,000; 0, J W Birket, a

N w cor Myrtle st and Hamburg av, 2 fr dw: 18 store: cost, \$17,900; o, John Rueger, a, H Vollaridi. S s Covert st, xoo w Bushwick av, 3 fr dws and smc cost, \$9,000; o, Burkhard & Decker; a, owner.

W s 5th av. too w Butler st, 3 brdws and stores CS \$18,000 all; o, Farrell & Eagan; a, 1 hos Easop.

ST. I.OUIS, MO.—Channing av and Locust st, brit stable; cost, \$7,000; o, R W Crittenden; b, k W Morrison.

18th and Chontean av, br dwell; cost, \$7,000; 0. F F Spilky; b, T F Marley.

N S McDonough, 300 e Patchen av, 11 brdw; (85 55,000 all; 0, John G Porter; a, not given.

8th st and Chrysty av, br and stone sect; (85 \$50,000; 0, Cunningham Bros; b, R P McClert. Penn and Cambria aves, br flats; cost. \$7,000.5. L Freund & Bro; sub let.

IN PRESS.

SOME DETAILS

WATER-WORKS CONSTRUCTION

By W. R. BILLINGS,

Superintendent of Water-Works at Taunton, Mass. WITH

Illustrations from Sketches by the Author. INTRODUCTORY NOTE.

Some questions addressed to the Editor of The Engineering and Building Record and The Sanitary Engineer by persons in the employ of new water works indicated that a short series of practical articles on the Details of the structing a Water-Works Plant would be of value; and, at the suggestion of the Editor, the preparation of these papers was undertaken for the columns that journal. The task has been an easy and agreeable one, and now, in 3 more convenient form than is afforded by the columns of the paper, these miles of actual experience are offered to the water-works fraternity, with the belief that they may be of assistance to beginners and of some interest to all.

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THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE LIGHTING OF LIVING ROOMS.

THAT a healthy room is usually, if not always, a light room, and that there is some connection between darkness and disease, in addition to the fact that both words begin with the same letter, and that they therefore sound well together, is generally admitted.

When, however, we come to consider the principles or rules which either do or should guide the architect in his plans for either natural or artificial illumination, it will be found that they are rather empirical, and are not always or even frequently followed. M. Trélat's definition of a well-lighted room is, that it is one in which light has been introduced in sufficient quantity, and has been so distributed that objects in any part of it are clearly seen without special effort.

This is much too vague for either scientific or practical purposes. Must we require that a room shall be so light that one can in any part of it without trouble see clearly the eye of a fine cambric needle? That might be a proper requirement in a watch factory, but it is unnecessary to demand it in living rooms.

On the other hand, it seems probable that to keep a living room healthy it needs not only the diffused light of day, but the entrance of the direct rays of the sun-that is, we want sunning as well as lighting.

If we have an isolated house in this latitude, its east, west, and south sides will be well sunned, while its north side will not. For such a house the rules for window height and area, from a sanitary point of view, are that for rooms having windows upon but one side the area of the openings should be at least one-fourth or one-fifth of the area of the wall in which they are placed, and the distance from the window to the opposite wall should not be more than 11/2 times the height of the top of the window from the floor. If we consider houses in a city we have to take into consideration the shadows cast by other houses and the width of the street in its relation to the height of the houses upon it. The theoretical rule is that the height of buildings on a street should never exceed 11/2 times the width of the street.

Although, as stated above, the north side of the house is less sunned, yet north windows give a very agreeable light. They are preferred by those who work immediately in front of windows, as microscopists, draftsmen, etc., and are strongly recommended for the main source of lighting of school-rooms, though in this case they should always be supplemented by windows in the east or west walls. For bedrooms south windows are preferable.

In the lighting of school-rooms the chief

point as to direction is that the principal light should come from the left of the scholars, and that they should never face the light. So long as these rules are observed there cannot be too much light in a school-room, and there need be no fear about cross lights unless the room is to be used as a drawing school, and even then it is easy enough to cut off the light from one side.

In living rooms, and more especially in drawing-rooms and parlors, the full benefit of the windows is, as a rule not obtained. They are more or less obscured with curtains and draperies which are so arranged as to cut off precisely that part of the window which is most important for illuminating purposes—viz., the top. Careful housekeepers do not want sunlight in their

parlors, and, so long as this is the case, it is probable that they will not have it, sanitary reformers to the contrary notwithstanding.

In planning a dwelling, therefore, we should try to give the windows of the bedrooms such an aspect that they will receive the sunlight, and the same should be done for the room which is to be the chief sitting and living room, while the apartments of state can do very well without much natural illumination.

NEW YORK PAPERS ON RIVER AND HARBOR WORK.

It will be remembered that we published on February 11 a copy of a letter sent by Capt. Wm. H. Bixby, of the U. S. Engineer Corps, to the Wilmington Messenger, showing the great improve-ment effected in the inland navigation of the

Carolinas by a comparatively small expenditure.
In an unguarded moment Captain Bixby addressed a similar communication to the New York Sun, with the result of producing a violent explo-Whether that great central luminary felt affronted by the suggestion of enlightenment from any external source or was chagrined by the confessed suspicion that the same information had been given to other journals as well is not clear, but that Captain Bixby's letter was for some reason considered objectionable is very plain, for our esteemed contemporary straightway fell foul of it in most unamiable fashion, and after characterizing it as "a recitation of the stock arguments in favor of engineer work upon the unnavigable little streams of the country, and North and South Carolina in particular," and stigmatizing the Captain's figures as "untrustworthy," apparently for no better reason than because they showed a development of commerce amounting to \$12,950,000 annually as the result of a total expenditure of \$500,000, it proceeds to remind the unfortunate officer that it was "tolerably familiar with the subject while he was yet a cadet in the Military Academy.'

This ill-natured and uncalled-for attack called out an editorial from the Charleston News and Courier, in which it says: "The Sun wants to know what is this army officer driving at." "It is equally to the purpose to ask what is this newspaper driving at?" and makes the following further comments on the strictures of the Sun:

Surely there is no good reason why a digest of the information which has been presented to the War Department and to Congress should not be communicated to the newspapers in order that they may be in possession of the truth when they discuss the proposed appropriations in the River and Harbor bill.

"The Sun speaks very lightly of the 'creeks' of the South Atlantic States. It forgets, or is ignorant of the fact, that many of the so-called 'creeks' of the South Atlantic coast are either longer or broader or deeper, and carry more water, than many of the so-called 'rivers' of the New England and Middle States. The Sun should not measure our mighty creeks by the petty rivers with which it is familiar, and should remember, besides, that there is no attempt in the Carolinas to create waterways which have no existence. The work here is confined to improving the waterways which, in a more or less navigable condition, are here already.

"The Sun remarks that it would like to learn whether Captain Bixby 'regards it as a part of the duty of a captain of engineers to lobby for big appropriations by Congress for the creeks and sand-bars, or to undertake to educate the newspaper press of the country up to his

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views of the desirability of a policy of lavish expenditure.' This is not courteous or fair. No body of men in the United States are more independent of political considerations and political parties than the Engineer Corps of the United States Army. They have no personal interest in large appropriations or small appropriations. They hold their rank and draw their pay whether the rivers and harbors are improved or not. If there is an instance in which an engineer of the United States Army has been truthfully accused of jobbery or fraud, the News and Courier is wholly ignorant of the circumstance. To the engineer corps the public and the politicians can and do look with confidence for plain statements of unvarnished facts. They possess the confidence of the public, and it is not reasonable or just to deride one of the most capable officers of the corps for understanding his work, or to scold him for taking pride in its progress and performance."

It is unfortunate that a journal whose brilliancy is usually worthy of its name should have, on apparently such slight provocation, allowed its bile to get the better of its brains

The Sun, when it recently bewailed the neglect of Congress to act on the advice of the late Samuel J. Tilden to provide adequate coast defenses for our great cities, could have found a reason in the prejudice existing in Washington against any expenditure for our Eastern ports because of the persistent and indiscriminate opposition to appropriations for improvements in the West and South on the part of leading Eastern papers.

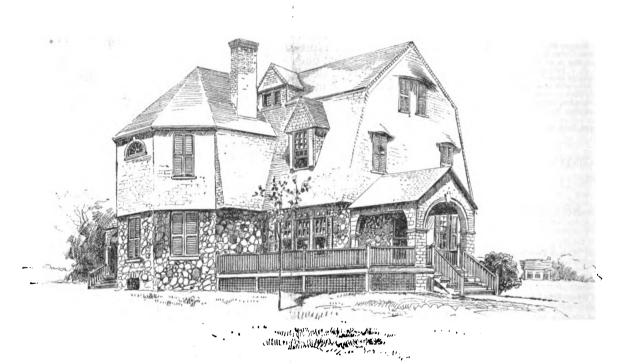
It is high time that the citizens of New York should be led by at least an intelligent self-interest to realize that we are one country, not an aggregation of antagonistic sections, and that no part of the nation can expect to derive the benefits that naturally belong to it that is not willing to do its full share in securing like benefits for all the rest.

into the present ones—in other words, their external fit.

Most of the designers have felt that the City Hall w_{ac} to be kept intact and was to mark the centre of a mass of building whose principal point of view was from the south, the Court-House being quite ignored.

Some of the designs, and these the most successful, show a feeling that some feature or features should rise at the back of the low central portion—the City Hall—and by their size and height connect the two high new wings and bind the whole into one composition. It should be remembered that the City Hall is, in the main, but two stories over a basement, while the new wings are six above the same

Perhaps the most successful, composition is that signed "Audaces Fortuna Juvat." In this the new wings are so arranged on the south front as to expose the whole of the City Hall. At the back of this building, and connected with the new wings by arcades, rises a great tower, presumably for records, some fifty feet square and perhaps four hundred feet high. The wings are so treated as



RESIDENCE OF MR. M'KIM, WORCESTER, MASS.-W. R. EMERSON, ARCHITECT.

and make such ill-tempered and uncalled-for There is, however, a possible statements. third reason for its conduct, which, unfortunately, is not confined to it, but is shared by many of the New York journals. It is briefly this: The improvements described and advocated by Captain Bixby are not in the immediate vicinity of New York, and, therefore, are to be opposed. This would be unfortunate enough as an exhibition of most unpatriotic sectional selfishness, utterly unworthy of those who claim to represent the thought of the chief city of the Western world, but unhappily it has serious consequences as well. We believe that it is largely due to the resentment naturally felt by those whose interests are thus constantly antagonized by the metropolitan press, and that means all the rest of the country, that it is so difficult to obtain adequate appropriations for New York harbors and waterways, and that the defenses of the metropolis are so ridiculously inadequate to the vast values they are supposed to protect.

OUR ARCHITECTURAL ILLUSTRATIONS. EXAMPLES OF MODERN FRENCH RESIDENCES.

RESIDENCE OF MR. M'KIM, WORCESTER, MASS.—W. R. EMBRSON, ARCHITECT.

THE COMPETITIVE DESINGS FOR THE PRO-POSED MUNICIPAL BUILDING FOR NEW YORK.

In a room adjacent to the Mayor's office in the Stewart Building the twenty designs received in competition for the new municipal building are now open to public inspection.

They are not well arranged for this purpose, being placed upon racks, with the drawings composing each set one over the other—a manner not conducive to their well being, as each set must be handled in examining the different sheets. We have had no opportunity for more than a hasty view of these designs, and that only with the purpose of determining with what degree of success the competitors have been able to fit the proposed buildings

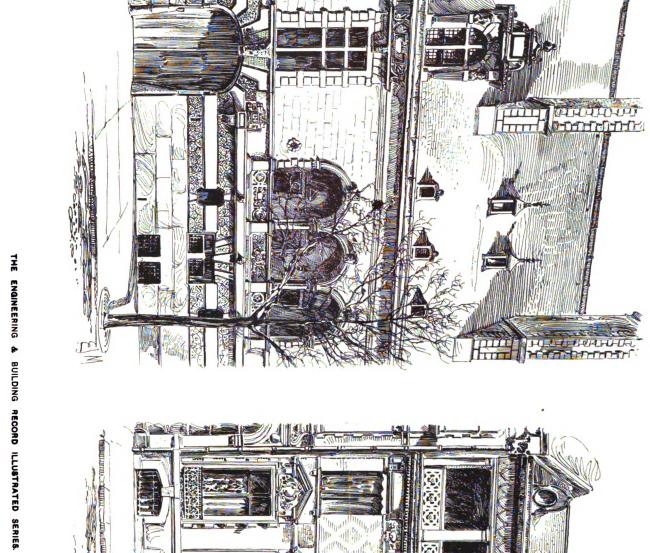
to recall the delicate refinement of the City Hall without continuing any great number of its features, with the exception of the cornices which mark its two stories. The flanking pavilions of the new wings are marked by pyramidal roofs which do not compose well with the strongly marked horizontality of the whole mass.

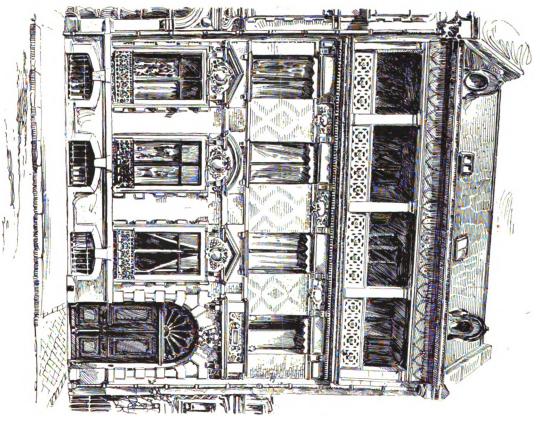
"Sans Peur" has attempted to reach the same result in his composition, but not with so much success, as he uses two towers, one at the back of each new wing. They are so far apart and the connecting mass of building is comparatively so low as not to bind his composition with the same degree of strength as in the design above mentioned. His treatment of the wings is more simple and self-restrained, and is quite in scale with the City Hall. His sky line is quiet to severity. His design may be criticised for its want of variety and plainness, but it is quite in keeping with what it is connected.

"Manhattan" No. 1 has not thought of the tower in his composition, but has given a plain, straightforward solution, well handled, well in scale, well disposed—though there is some unfortunate arrangement of windows in the upper stories.

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EXAMPLES OF MODERN FRENCH RESIDENCES.





"Manhattan" No. 2 has done fairly well, but has made the mistake of bringing his building more in the scale of the Court-House by the use of a colossal order.

This design has a peculiar resemblance to the Mutual Life Insurance Company's building.

"Three Interlacing Circles" has a carefully studied design very carefully drawn.

When these five designs have been considered, the last of even fair solutions of a difficult problem has been reached.

While none of them has solved it with success, they have each felt the extreme difficulty of it, and, by a bold self-restraint, have produced results which are at least praiseworthy.

In the second rank should come "New York," who has followed the original plan—as sent out by the commission—too closely, and, in consequence, has found great difficulty in roofing his retreating pavilions, and, when he has succeeded, produces a woeful result; "Harmonia Cum Utilitate," whose design belies the first part of his nom de plume, being open to the same criticism as "New York," and being, moreover, quite out of scale.

"Je Maintiendrai" and "Law and Order" add a third story to the City Hall, while the rest of the design gives them no excuse for such a liberty.

"Poietes"—whatever that may mean—and "Architect" have gone into eccentricities with Mansard roofs and things of that sort.

The rest of the designs taper off in a succession of atrocities; perhaps the worst being that by "Sans Peur, Sans Reproche," which is in the most wicked and abandoned French Renaissance, contemplating a steep roof on the City Hall and a composition of clock, fleche and flanking pavilions closely studied from the Hotel de Ville in Paris, but with domical roofs and other queer things.

"Albinus" runs the preceding hard for last place, but has used a nameless style which defies classification.

"Vitruvius," with his classical name, has ignored the City Hall, the Court-House, and Mr. Eidlitz's addition, and has gone in for Romanesque, and very bad Romanesque at that, while "Respice Finem" has followed his example.

There are also designs by "Leo," "Seven Circles," "Flower in Circle," and "Pro Bono Publico," none of which are as the last named.

An inspection of these drawings has shown very plainly how exceedingly difficult, from an artistic point of view, is this problem. The chief difficulty, as we have before pointed out, is in treating the great seven-story wings of the new buildings so as to be in harmony with the refinement and delicacy of the City Hall, and none of the designers have accomplished this without resulting monotony and tameness of effect. "Sans Peur"has, perhaps, made the nearest approach to it, but with the result that his composition, as a whole, lacks the strength and unity of that of "Audaces Fortuna Juvat."

The other designs placed in the first rank have some of the faults and some of the excellencies of those above named.

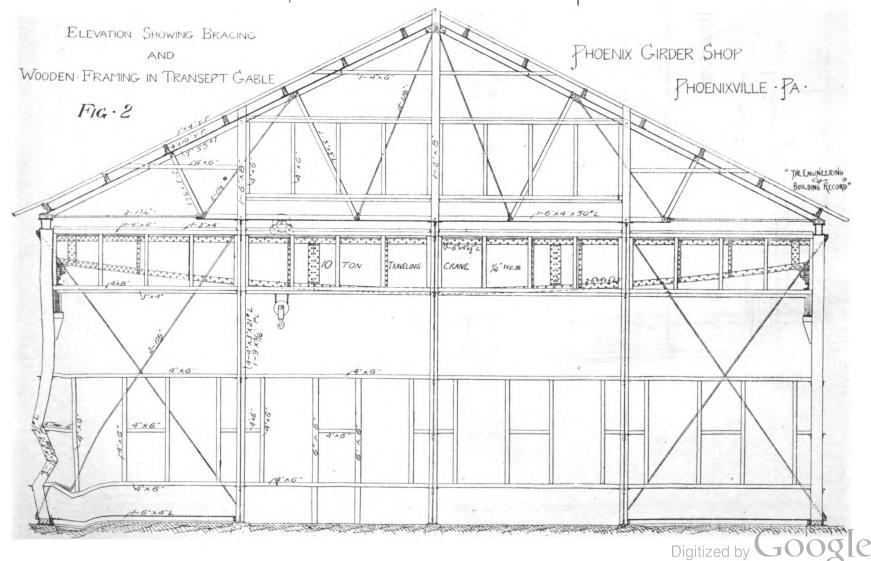
THE NEW GIRDER-SHOP OF THE PHŒNIX IRON COMPANY.

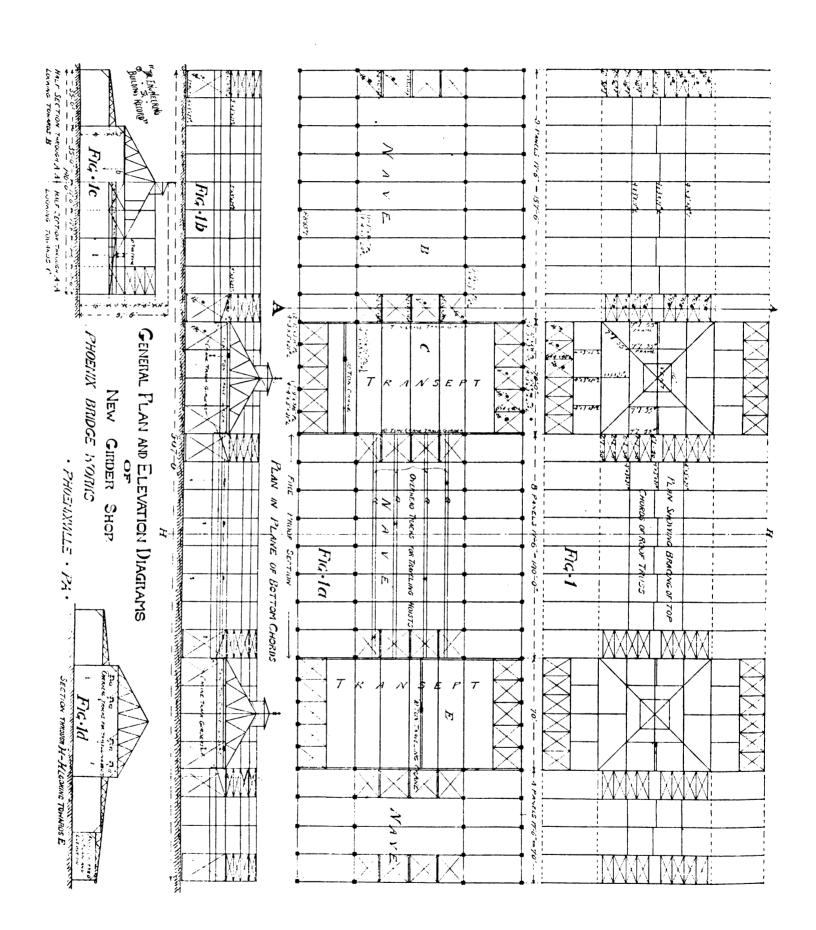
This building, intended, as its name implies, for the construction of all classes of structural work, except forged members, was built in 1887 by the Phœnix Iron Company, after the designs of the Phœnix Bridge Company's engineers. The present total dimensions of the main building are 140 feet width by over 500 feet long. An annex extending the whole length of the building on its south side is occupied by the engines, boilers, a smith shop for repair purposes, shop office, etc., but, as it is not an immediate part of the shop proper, is shown only in Fig. 1 d.

A central nave with 70-foot roof-trusses is crossed by two transepts 70 feet wide and 140 feet long and 140 feet apart. The nave is flanked on each side by an extension or wing, 35 feet wide, whose outer columns are in line with the transept gables and give the building a rectangular outline. The roof-trusses are spaced 17 feet 6 inches apart, and it is intended to add to the west end of the nave as occasion requires. The lower chords of the main roof trusses are made stiff enough to sustain transverse s'rains, and from them are suspended several trolley-tracks carrying hoists of from 5 to 15 tons capacity, some of which are shown at a a on the general plan and section. Various tools and heavy machinery suitable for the fabrication of the heaviest bridge work are conveniently located about the building. The trolly-tracks above mentioned are so placed as to serve the different machines with the least amount of labor. Each transept is spanned transversely by a traveling crane 70 feet in length which moves on tracks supported on plate-girders running along each of its sides. In this manner every point of each transept is completely commanded by a traveling crane arranged to hoist and handle in the most expeditious manner bridge members weighing from 10 to 18 tons. Five lines of railroad tracks run longitudinally through the nave and across the transepts and deliver material at any point in the building. The shop is abundantly lighted by numerous side lights in the walls of the wings, in the walls of the nave above the wings, and in the sides of the ventilator lantern or louvre. The walls are covered with corrugated iron and the roof with slate laid without sheathing on pine laths or nailingstrips, except in the braced panels on the outer side of each transept, where 21/4x11/2x1/4-inch angles are used, as shown in Figs. 6 and 7. This construction was designed to prevent the spread of fire, the metal roof insulating, as it were, the sections each side and dividing the building into three parts, the central one containing the two transepts and intermediate portion of nave, and the end ones comprising all the nave beyond the transepts. The roof of either of these divisions might, it is thought, be burned without the fire spreading across the adjacent fire-proof panel.

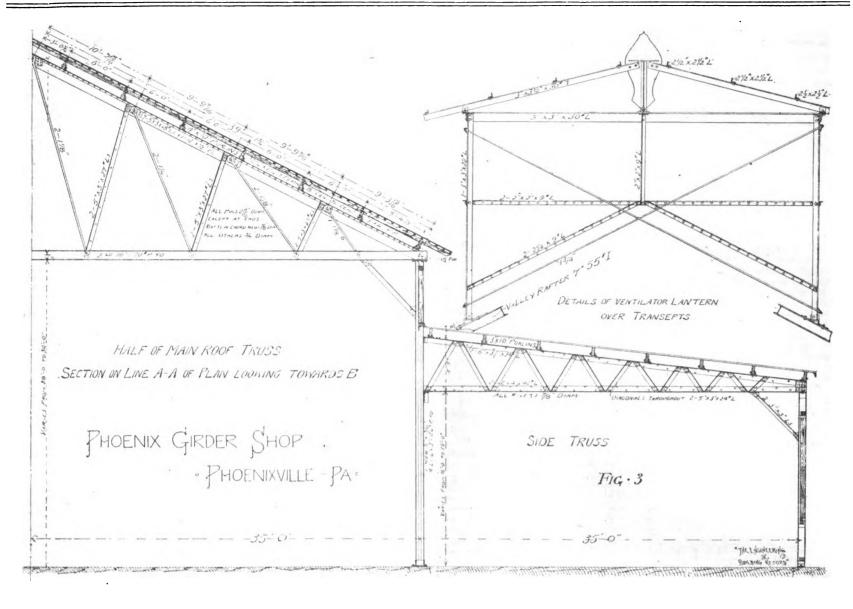
All roof-trusses are bolted firmly to columns with proper provison for expansion and contraction produced by changes of temperature. The whole building is rigidly held by systems of lateral bracing and heavy knee-braces against the severest wind pressure or the shocks and vibrations of the heavy shafting and machinery which it contains. In the erection of the building the columns were set up with small derricks and anchor-bolted. The rooftrusses were then assembled and connected at the feet of their respective columns, elevated into place and riveted or bolted in their final positions. The purlins and rafters were designed for a total load of 40 pounds per square foot. In addition to the wind, snow, and dead loads, those members of the roof and transept trusses which carry a live load of machinery and of bridge members in process of fabrication were designed for this additional duty. The main transept girders are proportioned to carry two 10-ton cranes each in any position not less than 10 feet apart. All iron-work is designed with working stresses from onefourth to one-fifth of its ultimate strength. The total weight of iron in the roof is a little more than 1,000,000 pounds.

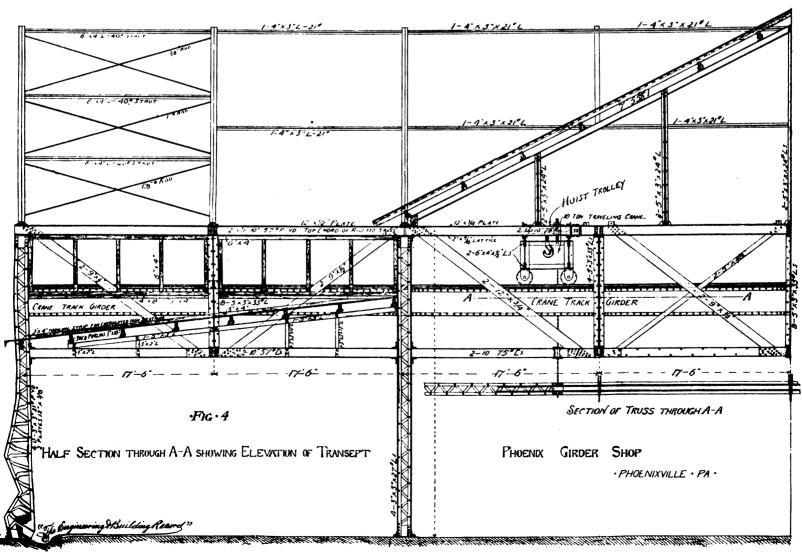
This building was specially designed to meet the demands of the heaviest long-span structural business of the Phoenix Bridge Co.

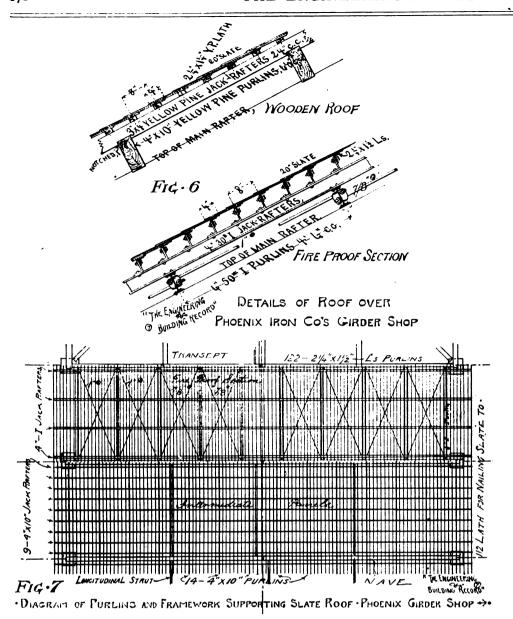


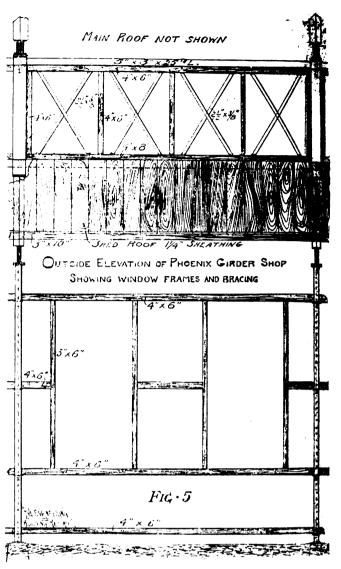












CHELSEA CITY ENGINEER'S REPORT.

THE report of Mr. William E. McClintock, City Engineer of Chelsea, Mass., for 1887 contains the following item of interest in regard to macadamizing highways. He says: "It has been our policy to take a section of the city and repair all bad places in walks and use about so much money each year.

"The principal feature for the year just past in this department is the addition of a complete new plant for macadamizing streets. This includes a 10x15 Farrell & Marsden stone-crusher, costing \$586; a 15-ton Aveling & Porter steam road-roller, costing \$5,000; a 20-horse power portable engine, costing \$822, and a platform and house at the crusher so arranged as to allow of delivering the stone at the jaws of the crusher so as to prevent the handling it over again. In arranging this platform we have taken advantage of the natural contour of the ledge and placed it about fifteen feet above the pit. The stone passes from the jaws of the crusher into a rotary screen, that is made to revolve by the same power that runs the crusher, and from here it falls through shoots that separate the broken stone into four different grades depending on the size. The bins are of sufficient capacity to hold two days' breaking without moving any stone. By this arrangement two men can easily feed the crusher and one man runs the engine, and this is all the expense for labor. The actual cost of breaking per ton was figured on 1.418 tons, the total amount broken, and is as follows:

	\$0.013
	0.016
	0.75
• • • • • • • • • • • • • • • • • • • •	0.194
	0.05
	· · · · · · · · · · · · · · · · · · ·

"If the cost of the platform be added to this it will amount to an additional \$0.267, or \$1.29 for the whole, which is about 30 cents less than it cost last year for the same work, and we now get first-class material against very poor stuff at that time.

"The steam road-roller, which to many was considered a luxury, is what will give us the very best results from our stone. With the old roller we could not roll the streets

that we repaired, as one roller and a pair of horses could not get over the ground fast enough. With the new roller we can lay a section of street down so that a seven-ton team with narrow tire makes no impression in it while passing over, and we can do this as tast as the street can be covered and still leave time for the same engineer to run the crusher for other work.

"The cost of rolling the past year is not a fair estimate of what it will cost, as many things are figured into rolling that will not occur again, as our outfit is now complete. There were rolled in the short time we worked about 6,275 square yards at an average cost of $4\frac{1}{3}$ cents per yard. The above figures will plainly show that the outlay on the outfit for macadamizing streets is not an experiment as far as the cost of the work is concerned."

Six thousand seven hundred and twenty-three lineal feet of new sewer of wood and Portland and Akron pipe from 6 to 18 inches in diameter was built at a total cost of \$9,135.27; the assessments for which per 1,000 square feet of property benefited varied from \$3.31 to \$9.65.

In preparing plans for the assessors it is necessary to look up a great many deeds in order to correctly locate the lots. These deeds are then entered in a deed indexbook which will save much time hereafter in looking up property.

Nearly all the drains, also, whether new or old, have been examined and located in the books kept for that purpose and indexed alphabetically by streets.

RAISING COLUMNS OF ST. ISAAC'S CATHE-DRAL, ST. PETERSBURG.

This operation, as described by Mr. R. L. Venables in the London Architect, was extremely interesting, from the size of the columns and the height at which they were placed, being the second tier or story of columns. Its base must be 130 or 140 feet from the ground. Each column is a solid block of granite, 42 feet high, and weighing 5,000 poods, or upwards of 80 tons (larger than the columns of the Panthéon, and both larger and better wrought than any column found in the ruins of Zenobia's capital). The columns on the ground tier, each of which is also a single stone, are 56 feet high, and weigh 11,000 poods each.

He says: "When I reached the platform to which the column was to be raised, I had below me a panorama of Petersburg, and the country around for many a mile, the most interesting part of the prospect being the Gulf of Finland, down which I could see as far as Cronstadt. From the platform down to the next stage, a depth of about 80 feet, was fixed a strong timber frame, covered with planks, so as to form a very steep inclined plane. At the bottom of the slide, when I first looked down, the column to be raised was lying horizontally on rollers; it was girthed round with very thick ropes drawn very tight, and padded underneath. Other ropes, or rather cables, secured to these girths, passed lengthways along the column, crossing each other over its lower end, and it was lashed to strong planks which lay under it, that the polish of the stone might not be injured in ascending the slide. Over the base on which the column was to stand was placed a high framework of strong timbers. The cables, twelve in number, attached to the column passed through blocks fixed in the frame, and, with the aid of one movable pulley to each, were drawn by twelve capstans, each manned by fourteen or sixteen men. There were two extra capstans for the purpose of guiding the lower end of the column when suspended in the air. Altogether, upwards of two hundred men were employed in the operation. When all was ready the capstans began to turn, and by degrees the column, instead of lying in a horizontal position, rested on the inclined plane, which was well greased, and began slowly to ascend, two men standing on its upper end, to be ready in case of the cables becoming entangled. The capstans were all numbered, and the superintendent at the top, by calling out sometimes to one gang, and sometimes to another, to move faster or slower. Kept all the ropes drawing equally. The column at length reached the top of the inclined plane, and it was then raised until it was hanging in the high wooden frame exactly over the base on which it was to stand. A c

THE interesting and important work on the "Railroad Suspension Bridge at Niagara," by L. L. Buck, M. Am. Soc. C. E., which was the subject of a paper before the American Society of Civil Engineers, is being described with illustrations, by our foreign contemporaries, London Engineering and Le Genie Civil.



1



STATION J OF THE NEW YORK STEAM CO.

WHEN, in 1881, the New York Steam Co. began its operations it proposed a very comprehensive scheme for supplying steam throughout Manhattan Island, and, with that object in view, selected and in most cases acquired convenient sites for steam stations throughout the city. These stations were to be designated alphabetically from the Battery north, and in most cases were located with a view to convenience of obtaining coal from the water-front. The site acquired for Station A at 17 Front Street has so far been used only as a storage-yard. Station B, though hardly more than half finished, yet, with its huge chimneys, amply dominates the block bounded by Greenwich, Cortlandt, Washington, and Dey Streets, which, with its annexes, it largely fills, and is a familiar landmark to those who cross the Jersey City ferries. This building is designed to accommodate on four floors 64 Babcock & Wilcox boilers of 250 horse-power each, a total of 16,000 horse-power, and to store 1,000 tons of coal on the fifth floor, which is 90 feet from the ground.

This building now contains 48 of its boilers, and though its facilities for storing and handling coal are yet incomplete, it supplies an aggregate of 12,000 horse-power to 1,000 customers in a district extending from Reade Street to the Produce Exchange and as far east as Pearl Street.

Steam at a pressure of 80 pounds is taken from the building in three mains of 11, 15, and 16 inches in diameter respectively, while provision has been made for a third main 30 inches in diameter. There are 5 miles of steam-mains from 6 to 16 inches in diameter, most of them over 11 inches, with a corresponding length of return mains from 4 to 6 inches in diameter, and several miles of service-pipes averaging three inches in diameter and some as large as 8 inches. The furthest point supplied is three-quarters of a mile from the station.

While a detailed description of this unique building,*
even in its unfinished state, would be of much interest, it

would, in view of the vastness and complication of the plant, be a very difficult and relatively unsatisfactory undertaking. We have therefore thought it wiser to describe Station J, located on Fifty-eighth Street, near Madison Avenue, which has the advantage of being a completed building, and, with the exception of blowers, contains practically all the details to be found in Station B, but perfected by the experience there acquired and simplified by the relative smallness of the plant.

Stations B and J, and a rudimentary one in the upper part of the city supplying the neighboring works of the Standard Gas Company, are the only ones which have thus far been put in operation.

Station J was located and designed primarily to heat the handsome residences to be found in its neighborhood, and while its boilers and pipes are well able to carry a pressure of 80 pounds they are usually run at half that

This building, as will be seen by reference to the accompanying plan, is arranged to accommodate fifteen Babcock & Wilcox boilers of 200 horse-power each, a total of 3,000 horse-power, of which only seven have been put in, their location being indicated by the grates A A. In the yet unoccupied stalls are shown the ash-hoppers G G, while the descending flues are shown at B B, and at C C are cleaning-doors giving access from the cellar to the spaces back of the bridge wells. The feed and blow-off pipes are shown at E E and F F respectively; the steam-pipes, being overhead, will be shown on a subsequent plan. The outlet of the coal-shutes from the overhead bins is shown at D D.

The methods of handling and storing coal and of getting out the ashes, together with the general arrangement of the various pipe-systems, will be described in subsequent issues when sufficient plans have been given to render such description intelligible.

(TO BE CONTINUED.)

PHILADELPHIA MASTER PLUMBERS' ASSO-CIATION AND TESTS OF HOUSE DRAINAGE.

(Special Correspondence.)

PHILADELPHIA, April 3, 1888.

One of the rules regulating the ventilation and drainage of dwelling houses in the city of Philadelphia requires that the soil-pipe shall be subjected to a test that will satisfy the inspectors of the Board of Health. No particular test or method of test has yet been adopted by the Board of Health as a universal standard, and the plumbers have been using numerous devices for the purpose; but the

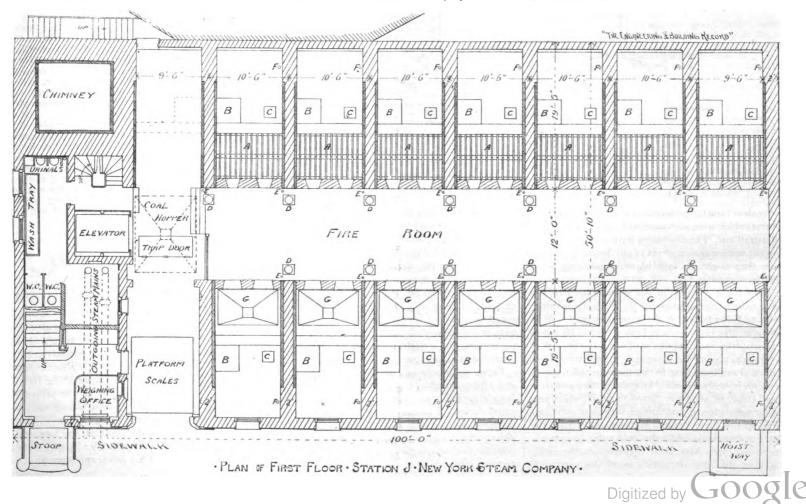
question of adopting a standard test which will be required by the rules of the board has been under consideration for some time, and the Master Plumbers' Association, at their last monthly meeting, directed the Sanitary Committee to prepare for and make such tests of the different appliances used as they saw fit, and report the most practicable and efficient method to the association.

The Sanitary Committee, on March 29, held a meeting, of which public tests of a number of appliances were made by both the smoke-pressure methods. They will prepare a report.

A COMMON-SENSE VIEW OF THE NECESSITY OF ENFORCING A PLUMBING ORDINANCE.

THE Burlington, Iowa, Free Press gives the following very sensible advice to its Health Committee:

"The plumbing ordinance was adopted by the city in compliance with a very distinct public demand and has been productive of very beneficial results. That if it is steadily enforced it will have a constant and valuable effect in the prevention of epidemics and promotion of the health of the city, we suppose no well-informed person can doubt. But, of course, to be of any service it must be squarely sustained and impartially enforced. It is just the kind of an ordinance that cannot be enforced by fits and starts. If one individual is allowed to disregard it, the next one will claim exemption, and the statute will soon be a dead letter. For these reasons many of our citizens have viewed with concern the failure of the Health Committee to sustain the Health Officer and the ordinance, in the matter of the plumbing of Barrows Block. All that the Health Officer asked was compliance with the ordinance. That requires that the soil-pipe within any building be of iron. Health Officer Linsley finding that this requirement had not been complied with, ordered the owners of the building to comply with it. The latter appealed to the Health Committee, and the majority of the committee practically relieved the owners from the order of the Health Officer. Now our plumbing ordinance is not a rigid one. It is far less rigid than the plumbing ordinances of many cities. It was not enacted for the benefit of plumbers, but for the benefit of the health of the city. It requires only what the best authorities on the subject regard as indispensable. It costs owners something, of course, to comply with its regulations, but faulty plumbing and the breeding of infection on their premises would in the end cost them far more, if this were not so. The health of the public is of more consequence than the private interest of any individual. It is the Health Officer's first duty to look out for the public health; and he should be supported squarely by the Health Committee, or his usefulness is at an end. If he is fit for his office, his orders shou



^{*} A general description of Station B and its contents, and also of the street-work of the New York Steam Company, was given in Vol. VII., Nos. 8 and 9, of this journal.

A LECTURE ON PLUMBING BEFORE THE NEW YORK TRADE SCHOOL.

WE have from time to time noted the progress and development of the trade school established and maintained in New York by Colonel R. T. Auchmuty, through whose courtesy and that of Mr. Edward Murphy, the instructor in plumbing, we are enabled to present a report of the last lecture delivered by the latter before the class in plumbing. This class has received during the winter practical instruction in the use of tools and handling of work, and have acquired some skill in workmanshin and made many specimen jobs at the benches in the class room. Mr. Murphy has also given them theoretical instructions in a series of lectures treating of drain and soil pipes, their trapping and ventilation, hot and cold supply pipes, boilers, tanks, pumps, fixtures, and of the different problems arising in practice, their best solution, and the mistakes commonly made, explaining the best practice and the principles involved

The course was divided into topics, of which the outline and diagrams were printed and furnished to the students injured or destroyed. This mistake does not often occur, but is sometimes made, especially with a range which has a long water-back, whose hot and cold pipes, H and C (sketch A), are not easily distinguished. Of course, the hot and cold pipes should be arranged as shown in dotted lines D F H and C R I. Care should always be taken to determine which of the water-back couplings is lowest and connect the cold-water pipe to it.

In Fig. 22 B is the boiler. W the water-back, I G R the hot-water supply to upper floors and R L E the circulation-pipe, which is a continuation of the supply-pipe, brought back to connect with cold pipe at E. The object of this circulation-pipe is to enable hot water to be drawn from faucets at a distance from the boiler without having to first draw off a large quantity of cold water, as would be the case in drawing at A or F, when all the water contained in the pipe between those points and I would have to be drawn before any hot could be obtained. By returning the pipe from R to L E constant circulation is obtained and all the water is hot, and only the cold water in the branch between A and R or F and G—a pint, perhaps—has to be

then be opened to drain boiler I, and both boilers will either be emptied together or O must be emptied first.

Figure 24 shows an arrangement that is frequent in Canada and in New Orleans and some other places.

Hot and cold water tanks, E and T respectively, are placed together in the upper story of the house and connected with a pipe having a regulating-valve V that lets water pass in only one direction, from T to E.

The cold water goes down B C to the water-back W. is heated, rises through H A, and is drawn off through D S for house-supply.

This saves the expense of a boiler and the room occupied by it near the range and has the advantage of being easily built by any plumber and carpenter.

(TO BE CONTINUED.)

SIXTH ANNUAL CONVENTION OF NATIONAL ASSOCIATION OF MASTER PLUMBERS OF THE UNITED STATES.

THE sixth annual convention of the National Association of Master Plumbers of the United States will be held in Boston this year on June 26, 27, and 28.

THE REGISTRATION OF PLUMBERS IN GREAT BRITAIN.

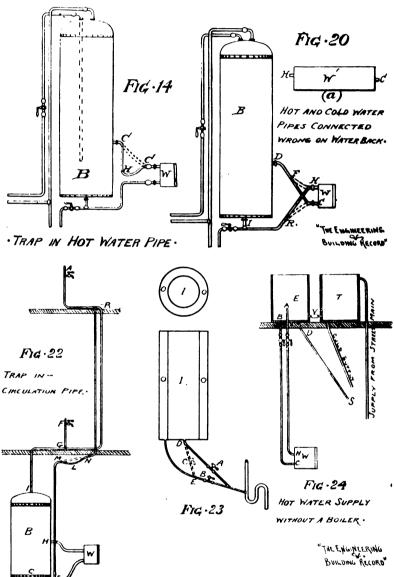
An influential meeting of citizens was held under the Presidency of Professor Sir Douglas Maclagan, to discuss the propriety of forming a district council for Edinburg and the east of Scotland, to act in concert with the London Plumbers' Company in furthering the scheme for a national system of registration. It was generally felt at the meeting that the object in view was a very important one, and that every effort should be put forth to insure its accomplishment. As the whole of the fraternity of plumbers had been canvassed in regard to the matter, and a opinion was unanimously in favor of the project, the meeting at once proceeded to elect the district council, consisting of about forty members, on which the master plumbers, the operative plumbers, and the general public are equally represented. The Council having been duly elected, it was further entrusted with powers to draw up rules for carrying on the movement. On the Council are several medical representatives, also a considerable contingent of leading architects and engineers, so that it is well balanced leading architects and engineers, so that it is well balanced in its constitution, and well adapted to exercise the important functions that are to be assigned to it.—Lancet.

THE TORONTO PLUMBING LAW.

A JOINT meeting of the Water-Works Committee and Local Board of Health was held to finally revise the plumbers' by-law before it is submitted to the Council. Alderman Boustead presided, and in addition to the members of the committees there were present Messrs. Wright and Burroughes, representing the master plumbers; Mayor Clarke, Medical Health Officer Canniff, and Assistant Engineer Maddough!

Engineer Macdougall.

A three hours' discussion took place, in which the Aldermen showed a great deal of interest in the different clause under discussion. Among the changes made were the following: As the American laws exclude all persons except Americans from receiving a plumber's license, it was decided that those to whom licenses are to be granted must be British subjects or Canadians by birth or naturalization. The clause requiring master plumbers to give two sureties in \$1,000 was altered to read \$500. The employer is to be held liable for all work done under his charge. All private drains are to be laid by the Engineer's Department between the sewer and the street-line before the housedrain is laid in order to get the proper levels. All the taps, etc., are to be stamped with the name of the plumber. All soil-pipes must be of iron instead of the glazed drainpipe formerly used. A certificate for work done is not to be issued for 30 days. All plumbing work is to be left open and uncovered until inspected and approved of by the proper inspector.



in a convenient form for preservation and reference during the lectures, which were accompanied by object and blackboard illustrations. The concluding lecture was devoted to pointing out some common errors in city-house plumbing and how they might be avoided, and explaining some desirable arrangements.

The following is a report of one of these lectures, the cuts being reduced reproductions of the illustrations used

In Fig. 14 B is a boiler, W the water-back, and C H C the hot-water pipe bent so as to form a trap at H, where steam accumulates and remains until it condenses, and is forced through, making the disagreeable hammering often complained of as threatening to tear the boiler off from its stand. This is easily remedied by making the pipe have a continual slope, as shown in dotted line. C C, which permits any accumulation to pass through without obstruction.

In Fig. 20 B is the boiler and W the water-back, H the hot-water connection, and C the cold-water connection, but the boiler-pipes have been connected to the wrong couplings, so that the circulation would be very much

drawn before it runs hot. The trouble in Fig. 22 is that any trap or sag, as at L, in the circulation-pipe will destroy the whole system, for the colder water arriving there on its return to the boiler will immediately settle and cannot be forced out by the lighter hot water. The pipe should be carried in the straight dotted line M N, and must be laid with a constant fall at all points and free from any sag or trap. The principle would be illustrated by pouring very fine bird-shot into the top of the pipe; if there is a continual downward slope, the shot would run through to the bottom, but a slight rise forming a depression would immediate.y choke up.

Figure 23 shows a double boiler, with inside cylinder I and outside cylinder O O, and the sediment-cocks A and B so arranged that either boiler may be independently emptied, and the danger arises that the inside one, I, may be carelessly emptied first, causing its certain collapse and destruction. This is prevented by changing pipe D A to position shown by dotted line D E connecting with pipe from outside boiler above its sediment-cock B, which must

Novelties.



COMBINATION COMPASSES.

La Semaine des Constructeurs notes a new drawing instrument as shown in the accompanying figure, which can be used, first, as an ordinary pair of compasses with legs a a; second, as proportional dividers by attaching the third leg b and its link c in the proper position; and third, as a pantagraph, by attaching a supporting pin at d, perpendicular to the plane of the legs, and to c, c and c respectively a fixed needle point, a tracing point, and a pencil.

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Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ADDRESS OF ASBESTOS MANUFACTURER WANTED.

BRIDGEPORT, CONN., April 4, 1888.

SIR: Can you inform us who are the makers of, or agents for, "Toup's Asbestos Covering" for steam-pipes?
Respectfully, BRIDGEPORT STEAM-HEATING CO. C. Y. Beach, Treasurer.

[Referred to our readers.]

ADDRESS WANTED.

JERSEY CITY, N. J., April 4, 1888.

SIR: Can you give us the address of the Merrill Steam Air Moistener Company? They were formerly at 1168 Broadway. We noticed their advertisement in the book "Handy Facts." Yours truly. Yours truly,
A. A. GRIFFING IRON Co.

[Referred to our readers.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York	Manhattan	Metropolitan	Mutual	Municipal	Knickerbocker	Equitable
	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas-Light	Gas Light
	Company.	Company.	Company.	Company.	Company.	Company.	Company.
March 31	25.34	19.60	22.03	30.23	28 76	22.79	24.98

ELECTRICAL TRANSMISSION OF POWER.

As an interesting instance of the transmission of power by electricity over long distances, that at the Phoenix Gold Mines in New Zealand may be referred to. The current Mines in New Zealand may be referred to. The current is generated by two No. 8 Brush machines, each capable of giving 20,000 watts, or 26 horse power; they are driven by Pelton water-wheels with a head of 180 feet. The current is conveyed to the motor about three miles distant, and back again, by a No. 8 B.W.G. copper wire (0.165 inch thick) nearly six miles long, supported on telegraph poles. The power lost in the line is only three horse-power. A Victoria motor is used, running at about 350 revolutions per minute; and the power is transmitted to the machinery by a belt the machinery by a belt

At Hatfield, on the Marquis of Salisbury's estate, the

River Lea is utilized to generate electricity which is transmitted to the house and over the estate for a variety of purposes. Two turbines are used—one to drive a forty horse-power Siemens alternating-current dynamo, for lighting the house; and the other to drive a sixteen horsepower Brush machine, for arc-lighting at night, and in the day for working the motors at the house and on the farm. Those at the house drive pumping and ice-making ma-chinery, and a twenty-four inch Blackman air propeller fixed in the roof for ventilating; on the farm the motors are used for elevating hay and corn sheaves to the tops of the stacks, for thrashing, for cutting rough grass with a chaff-cutting machine for ensilage in fields extending to a distance of two miles, for grinding corn, etc., to make fodder, and for other purposes. The motors have also been used for pile driving, for making coffer-dams where necessary in the river, and also for dredging the river and cleaning it of weeds. A Gramme motor, capable of raising 2,500 to 3,000 gallons per hour, pumps the town sewage into a tank at a height of thirty feet for irrigation. The conductors are carried overhead on poles about the farm, and underground in wooden troughs to the house.—
Electrician. chaff-cutting machine for ensilage in fields extending to a

PAVEMENTS AND STREET RAILROADS.

No. XXIX.

(Continued from page 196.)

WOOD PAVEMENTS IN PARIS.

In continuation of the series of pavement articles that we have published in previous issues, we have prepared a description of the present standard practice of paving with wood and asphalt in Paris.

The regulations and specifications for the work are translated from the Annales des Ponts et Chaussees, and will follow this weeks' introductory description of the conditions and methods of work in 1883, when the first satisfactory trial of wooden blocks was made.

We abstract below the paper of M. A. Laurent, Ingenieur des Ponts et Chaussees, published in the Genie Civil

Numerous failures in the use of wooden pavements

on public roads had discredited them in Paris, but their rapid extension and success in other countries, particularly in London, under very heavy traffic, has compelled the attention of the municipal authorities.

A new study of this mode of surfacing was demanded, not only on account of the hindrance occasioned by the constant reballasting of the more-frequented macadamized public ways, and by their frequent renewals, with the attendant mud, dust and increased resistance to traction, and restriction of traffic, but also by the quantities of waste material stopping the drains and endangering public health. The problem of replacing these macadamized pavements in the great thoroughfares involved its effect upon the sewers.

The administration favorably received the proposals of the London wood pavement company, who have successively obtained the contracts for more and more important work. In 1881 they paved their first section on a small portion of the Boulevard Poissonpiere and the Rue Montmartre; in 1882, and early in 1883, all the roadway of the Avenue des Champs-Elysees, from the Place de la Concorde to and including the Rond-Point, had been relaid with wooden pavement, and the Municipal Council has now just accepted their proposition to pave a large portion of six of the most important boulevards, the company guaranteeing its work for a long period, and the city in turn permitting them great liberty in the execution of the work by English methods.

The process of the Improved Wood Pavement Company essentially consists in the construction, on a perfectly rigid foundation, of an impermeable surface of wooden paving blocks (pavés) thoroughly solidified. The resistance of the pavement to the action of the wheels depends almost entirely on the foundation, the wood being intended solely for a covering to protect this foundation, and to secure, by its elasticity and the perfect uniformity of its upper surface, the smoothest possible rolling of vehicles.

Rigidity of foundation, solidity of blocks, and impermeability of the surface are the three points this system aims to secure.

(I.) Foundation.—This consists of a bed of Portland cement beton 0.15 m. (6 inches) thick, with top coat of cement mortar about 0.01m. (3/8-inch) thick. The beton is thus proportioned: A mixture of about one-third sand and two-thirds gravel is put in a bottomless box containing half a cubic metre (0.65 cubic yards), and after the removal of the box 100 kilograms (220 pounds) of cement are emptied on the heap. This is in the proportion, by volume, of about one seventh as much cement as there is sand and gravel, since 1,400 kilos is the mean weight of a cutic metre of good Portland cement heaped loosely.

The sand was dredged from the bed of the Seine and the gravel taken from pits on the seashore. The cement was furnished by the manufactory of Demarle & Lonquety, of Boulogne-Sur-Mer.

The paving-blocks should have a uniform thickness and not be laid on the bed of beton until after it has set, in order to exactly preserve the curvature of the surface of the beton required for the convexity of the roadway. In the Avenue des Champs Elysees the convexity was 0.42m. (16½ inches) in a width of 27m. (87 feet 7 inches), which represents a mean transverse slope of a little more than 3 in 100. This convexity, though less than first proposed by the company, appears to be a little excessive, and it seems that for a road under satisfactory drainage conditions the convexity might be diminished; 0.42m. is only a mean convexity, for, on account of the small longitudinal slope of the avenue, the grade of the gutters is not parallel to the grade of the street, but presents a series of short slopes from the hydrants to the sewer openings, consequently the convexity varies from 0.39m. (151/4 inches) at the hydrants to 0.45m. (1734 inches) at the sewers.

To exactly regulate the surface of the beton a series of transverse profiles were defined by stakes leveled to the grade of the top of the bed. Along each profile a strip of stiff beton was laid. The top of this beton was carefully leveled and smoothed and received a guide rule, laid flat, whose thickness exactly corresponded with that of the beton coating. This series of rules thus formed a set of guides close together, between which it was easy, with large straight edges, to level the beton to the required surface The first leveling could never be more than approximate, the surface of the beton naturally remaining somewhat rough. The exact level required, as fixed by the tops of the rules, was secured by the top coat of cement-mortar

which filled the spaces between the pebbles and made an exact surface. This mortar was first composed of 200 kilos of cement to a cubic metre of sand (336 pounds to the cubic yard), but this proportion proving too small it was increased to 300 kilos. It was always mixed with a great excess of water so as to penetrate the interstices of

(2.) Paving.—The covering is formed of small uniform blocks of red Northern #r 0.15m. (6 inches) high, 0.22m. (83/4 inches) long, and 0.08m. (31/8 inches) wide. These are set close lengthwise, with joints, transverse to the street, of about one centimetre (3/8-inch). The blocks are sent, ready for use, from England, where they were cut from planks of the ordinary size, 0.08m, thick by 0.22m. wide. The third dimension, taken in the length of the plank, forms the height of the block, so that in position the fibres of the wood are placed upright. The blocks are superficially creosoted after being cut.

When the foundation has set, two or three days after being laid, the blocks are set by the pavers. Owing to the light weight of the blocks the work of paving is very rapid. Between crossings the blocks are set in rows perpendicular to the axis of the street, with their longitudinal joints staggered exactly half the length of a block. The methods used at crossings to avoid a continuous joint parallel to the traffic are analagous to those used in stone paving. Special precautions should be taken to insure exact spacing and regularity of the rows. Before commencing a new row, a strip whose thickness is exactly that of the required joint is set edgewise in contact with the last row and the paver has only to set the adjacent blocks in contact with it.

The blocks do not at first adhere to the foundation and are easily displaced after the removal of the strips, and to maintain them in place, as soon as the strips are taken out a small quantity of bitumen is poured in the ioints. This liquid material fills the small spaces that may exist under the blocks and partially fills the joints, and in solidifying effectually seals the blocks.

The joints are then filled by a thin grouting of neat Portland cement, distributed by the aid of a broom. This should be done at least twice to insure perfect filling and the essential impermeability.

The pavement cannot be opened for traffic until after the cement in the joints has completely set, for which a delay of 4 or 5 days is considered necessary. During this interval the last operation is performed—viz., spreading a thin layer of dry sharp sand over the surface. The company claims that this dressing, crushed under the action of the wheels, incrusts itself in the wood and lends resistance to the wearing surface. It seems more probable that this coating is simply to protect the fresh mortar from the direct action of the wheels, for it can be maintained but a very short time on a traveled road, and is soon transformed into

a disagreeable greasy mud.

The paving of the Avenue des Champs Elysees was divided into two parts, in the first of which the city removed the old pavement, and in the second this work was

done by the company under a special contract.

For the first division, the removal of the old paving was commenced October 16, 1882; first beton laid October 20; commenced October 10, 1882; risk beton laid October 20; paving commenced October 24, and the first portion of the roadway opened November 2; the removal of old paving completed December 10; the last beton laid December 12; the surfacing finished December 14; the paving finished December 18, and the road completely opened December

The total duration of work for 14,000 sq. m. (18,340 square yards) of surface was 67 days, corresponding to an average progress of 2:0 sq. m. (252 square yards) per diem. Considerable time is necessary for the various successive operations, but only sufficient space should be maintained between them to prevent crowding and interference be-tween the workmen. These operations in the Avenue des Champs Elysees have always required 15 days, and though Champs Elysees have always required 15 days, and though this time might be somewhat reduced by decreasing the length of a section opened up, it is not safe to estimate for any shorter time; 15 days therefore constitutes the period necessary to put the work in operation and complete one section, and this time should be deducted from the total time to find the true daily advance, which would become in the above instance 270 sq. m. (324 cubic yards). The second part of the work commenced March 29, 1883, and required 62 days for a surface of about 13,000 sq. m. (17.030 square yards), giving the same mean daily

so, m. (17,030 square yards), giving the same mean daily rate of 210 sq. m. The actual advance was 275 sq. m. (330 square yards) per diem, and would have been much more if it had not been delayed by lack of materials. The conditions were much more favorable on account of the season, the absence of hindrances attending the commencement of work, and because the removal of the old pavement was done by the company, so that but for lack of materials an advance of 300 sq. m. (360 square yards) would have been made daily.

(To be continued.)



THE PROPOSED NIAGARA SHIP CANAL.

THE accompanying map shows the projected location of this canal, joining Lakes Erie and Ontario by a deep canal on American territory. It is a portion of one published by the Oswego Board of Trade in the belief that the success of the bill now before Congress will be furthered by a more general knowledge of the subject.

Six alternative routes are shown by dotted lines on the map, varying in length from seven to twenty-five miles, and estimated to cost from eleven to nineteen million dollars. They extend from the Niagara River above the Falls to the same river below the Falls, or to Lake Ontario, and have been surveyed by Mr. William Pierson Judson, Mem. Am. Soc. C. E.

The line apparently preferred ends at Wilson on Lake Ontario. Connection can be made with the Erie Canal at Syracuse through the Oswego Canal, as shown.

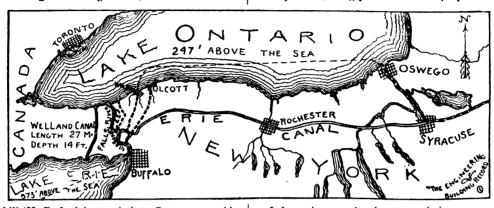
ant Engineer for Brown, Howard & Co., New Aqueduct, Tarrytown N. Y.; Edward Berton Kent, on a prelimiary survey for Chicago, Milwaukee and St. Paul Railway, Milwaukee, Wis.; William Willis Penney, Assistant Engineer St. Louis Water-Works, St. Louis, Mo; Louis Lincoln Tribus, Assistant to Charles B. Brush, Mem. Am. Soc. C. E., New York City; Harry R. Wheeler, Assistant Engineer Division r. New Croton Aqueduct, Sing Sing, N. Y.

AMERICAN WATER-WORKS ASSOCIATION.

THE eighth annual convention will be held at Cleveland, O., on April 17, 18 and 19, 1888. Headquarters will be at the "Hollenden," where special rate of \$3 per day is secured for those in attendance

An interesting feature will be the display by members of drawings representing a variety of novel ideas in waterworks construction.

Arrangements are also made for the associate members to display such samples, models or drawings of their productions or specialties as they may desire, special rooms, of easy access, being provided for this purpose.



The bill (H. R. 8.061) now before Congress provides for a commission composed of two members of the U. S. Corps of Engineers, two civil engineers, and one member of the Chicago Board of Trade; this commission to prepare plans for a canal to pass vessels of the class using the St. Mary's Falls enlarged canal-that is, nineteen feet draft.

Briefly, the proposed Niagara Ship Canal is intended to bring large steamers of 3,000 tons, or 100,000 bushels, 146 miles nearer New York than they can now come. Mr. ludson computes that this will produce a saving of freight charges of not less than three-quarters of a cent per bushel, and that the cost of the now proposed 20-foot canal will be nineteen million dollars by one route and eighteen millions by another.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

AT a regular meeting Wednesday, April 4, President T. C. Keefer presiding, after the transaction of regular business, the death was announced of George W. Cass, Fellow of Am. Soc. C. E., New York City, Charles Latimer, Mem. Am. Soc. C. E., Cleveland, O., and William A. G. Emonts, Junior Member Am. Soc. C. E., Reading, Pa., and the president was authorized to arrange for the preparation of their memoirs. A short paper was read by J. F. Flagg, Mem. Am. Soc. C. E., in the continuation of the discussion at the last meeting, on the "Flow of Sap in Trees," after which, by special invitation, Mr. R. K. Wright, Jr., lately Section Engineer on the Panama Canal, made some informal statements describing the condition and administration of the work, replies were offered by Messrs. Appleton and Colné, and some discussion by members of the society followed. The following gentlemen were elected:

As Members .- William Crulman Ambrose, Division Roadmaster Southern Pacific Railroad; Francis Webster Blackford, Jr., Resident Engineer Union Pacific Railway, in charge of construction work at Butte, Mont.; Howard Breen, Engineer Keystone Bridge Co., Pittsburg, Pa.; Edward Carlos Carter, Principal Assistant Engineer Chicago and North-western Railroad, Chicago, Ill.; John Joseph Donovan, Engineer in charge various branches in Montana of Northern Pacific Railroad, Helena, Mont.; Frank Louis Fuller, Engineer Marblehead Water-Works, Boston, Mass.: Bruce F. House Division Engineer Denver and Santa Fe Railway, Denver, Col. James MacFarlane, in charge of construction Anaconda Mining and Smelting Company's works, and of the engineering work in their mines, Anaconda, Mont.; Charles Clemons Rose, Division Engineer New York, Lackawanna and Western Railroad, Scranton Horace Edward Stevens, general engineering; Charles Frederick Stowell, Bridge Engineer New York State Board Railroad Commis sioners; Arthur Newell Talbot, Assistant Professor of Mathematics and Engineering, University of Illinois, Champaign, Ill. Charles Chancellor Wentworth, Principal Assistant Engineer Construction Department New River Railroad, Roanoke, Va.

As Associate.—George Henry Crafts, Bridge Constructor and general Contractor, Atlanta, Ga.

As Juniors .- William George Clark, First Assistant Engineer, City Engineer's Office, Toledo, O.; Arthur Leland Cornell, Assist-

Information as to hotel accommodations, space for display of products, may be had by addressing the Local Committee of Arrangements, of which H. F. Dunham, C. E., City Hall, Cleveland, is chairman.

Dunham, C. E., City Hall, Cleveland, is chairman.

Papers as follows are announced from among those promised: "Sanitary Protection of Rochester's Source of Water-Supply," J. Nelson Tubbs; "The Use of Salt-Glazed Vitrified Pipe," S. E. Babcock; Consumption of Water by Cities and Towns, H. W. Ayres; Water-Supply of Tokio, Japan, Y. Nakajima; "Quindaro Settling Basins and Syphon Well," R. C. Pearsons; "Reservoirs," Samuel McElroy; "Water-Works Records," J. M. Diven; "Weight and Thickness of Cast-Iron Pipe," J. W. Hill; "One Phase of the Problem," H. F. Dunham; "The Indirect Income of Water-Suppliers," F. L. Fuller; "Feed-Water Heaters and Condensers," Charles A. Hague; "Stand-Pipes for Water-Works," B. F. Stephens; "Recent Filtration Practice in India," S. Tomlinson; "Practical Results in Mechanical Filtration," William G. Richards; "The Use of Liquid and Gaseous Fuels," H. H. Harrison; "Approximate Determination of the Rental H. Harrison; "Approximate Determination of the Rental Values of Fire-Hydrants," J. Nelson Tubbs. Special rates have been secured from certain railroads,

particulars of which can be had from the Secretary, J. H. Decker, Hannibal, Mo.

PROPOSED IMPROVEMENT OF THE PORT OF PHILADELPHIA.

lT is proposed to extend the wharves on the water front of Philadelphia some 300 feet further out into the Delaware to accommodate the increased length of modern vessels.

To do this, however, and still leave sufficient width of channel to accommodate these large vessels it will be necessary to remove more or less of some of the small islands between Philadelphia and Camden.

When this is done, and the Camden wharves extended 300 feet also, there will remain an average channel width of 2,600 feet.

To remove these obstructions and obtain an average depth of 26 feet at low water, will, it is estimated, cost about \$3,000,000, and Col. W. P. Craighill, Lieut.-Col. Cyrus B. Comstock and Lieut.-Col. Henry M. Robert. who have investigated the matter for the Government, recommend that the work be done.

The Philadelphians are naturally desirous that the whole expense of the improvement be borne by the Government, but the engineer officers are of the opinion that if Philadelphia desires the acquisition of lands for this improvement it should purchase the islands and turn them over to the Government for removal.

CARELESS BRIDGE CONSTRUCTION.

On a railway bridge near Bombay the sills are said to project over the foot-plates of the locomotives. This, according to *Indian Engineering*, was the occasion of a recent "unfortunate accident," the engineer of a passing train having been summarily removed from his foot-plate by this ingenious man-trap.

DAMAGES COLLECTED FOR SEWAGE-FARM NUISANCE.

AT Warwick Assizes on Friday, before Mr. Baron Hud. dleston, an action was brought by William Thompson, architect, of Stratford-on-Avon, against the Mayor and Corporation of that town, to recover damages for nuisance occasioned by the Corporation sewage farm, and also to obtain an injunction to restrain the defendants continuing the farm under present arrangements. The Corporation of Stratford in 1885 set up sewage-works and farm within a quarter of a mile of plaintiff's residence, and from that time it was alleged a nuisance had been caused by horrible smells, which affected the comfort of plaintiff and his family, and depreciated the value of his house and land. Plaintiff complained from time to time to the Council of the nuisance caused, and made representations to the Local Government Board. In consequence Dr. Munroe was consulted, and advised the Council that the only way to remove the nuisance was to precipitate the sewage; but this work had not been carried out, owing to the heavy expense it would entail. Professor C. M. Tidy said he visited the works in February, and the stench from material then being removed from the tank was most offensive. The process that went on had practically no effect upon the sea age, and he had never before seen a worse-conducted place. Numerous other witnesses were called to prove that the nuisance was continuous, and had been in no way abated For the defendants, it was admitted a nuisance had been to no way abated. For the defendants, it was admitted a nuisance had been caused, but contended that the Corporation had done everything they could to abate it, and that plaintiff was only entitled to nominal damages. The jury gave a veronly entitled to nominal damages. The jury gave a verdict for the plaintiff with £1,000 damages, and his lordship entered judgment for that amount, and granted an injunction against the Corporation to be held over for twelve months.—Building News.

ACOUSTIC INSULATOR

THE Genie Civil recommends the use of shavings soaked in lime-water for packing between joists under floors to deaden noises, claiming that, besides adding little to the weight of the floor, this packing, if a solution of chloride of zinc be added to the lime-water, becomes incombustible

and drives away rats and mice.

It has been satisfactorily applied in hospitals and barracks, and is neater and cheaper than most substances commonly used.

Workmen handling it should wear roadmakers' specta cles to protect their eyes from the disagreeable dust, and should carefully wash their hands when leaving work.

MOVING THE HOTEL BRIGHTON

This enterprise is now well under way, and, the pre-liminaries having been arranged as described on page 230 of our issue of March 10, the locomotives were attached last Tuesday, and in two days moved the structure by short stages a total distance of 264 feet. Six locomotives were at first required to pull it up the initial grade, but when that was surmounted four were found sufficient to

ARCHITECTURAL DRAUGHTSMEN.

A number of architectural draughtsmen met in J. C. Cutler's office, at Rochester, N. Y., April 4 and formed a "T-Square Club." S. E. Hillger was elected president, and William H. Barnes secretary.

ENGINEERS' CLUB OF PHILADELPHIA.

THE club met March 17, Vice-President John T. Boyd

in the chair; thirty members and six visitors present: Howard Murphy, Secretary.

Mr. A. Marichal read a paper upon the "Testing of Cements," calling the attention of the club to the waste of money resulting from the incomplete knowledge of the

properties of cements.

Mr. Marichal asked for the appointment of a committee of five who would recommend a practical method of testing cements and present it to the club for its approval.

which, on motion, was ordered.

The sectretary presented, for Mr. Frederick II. Robinson, a complete description of the manufacture of gun-

Professor J. W. Redway followed with a discussion of the chemical reaction which takes place during the explosion of gunpowder and other explosives, giving a summary of results of experiments and investigations by self and others

Mr. L. F. Rondinella presented a paper upon "Incandescent Electric-Lighting," giving tables, formulæ, and calculations for the determination of the relative commercial values of lamps of higher efficiency and shorter life, with those of lower efficiency and longer life.

PERSONAL.

MR. JAMES C. BAYLES, President of the New York Health Board, and for many years editor of the Iron Age. has severed his connection with that journal.

MR. CHARLES KIRCHOFF, JR., who, for some time past, has had editorial charge of the *Iron Age*, is now announced as its editor.

MR. WM. R. BILLINGS, C. E., has resigned his position as Superintendent of the Taunton, Mass., Water-Works, and has accepted a position with the Chapman Valve and the state of Lating Cachend Mass. Mr. Manufacturing Company, of Indian Orchard, Mass. Mr. Billings' personal address is No. 15 Harrison Street, Taunton.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

FOR SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

COMPLETION OF THE ARCHES OF THE NEW HARLEM RIVER BRIDGE.

On Monday last the key segment of river arch of the new Harlem River Bridge, described in our issue of January 21, was successfully placed in position. This and the adjacent land span, completed some two months ago, are each of steel, with a clear opening of over 500 feet, and were furnished and erected by the Passaic Rolling Mill Co. All the arches are now completed, but it is not expected that the formal opening will take place before next fall.

TRADE CATALOGUE.

THE Silsby Manufacturing Company, Seneca Falls, N. Y., have just issued a pamphlet illustrating and describing a new portable, low-pressure, steam heating apparatus for public and private buildings.

ARCHITECTURAL COMPETITIONS.

ST. PAUL, MINN.—Several of the architects are working upon competitive plans for the new Germania bank building. The invitation to competition calls for two sets of plans, one set for a building 50x100, and the other for a building 100x100; but each must be for a seven-story structure, to be built of pressed brick and Bayfield sandstone.

WABASH, IND.—Plans are wanted here until June 11 for an Orphans' Home building. Address William Hazen, County Auditor, as above.

WEST SUPERIOR, WIS.—The compecition for pl for the new \$20,000 City Hall resulted in favor Architect J. D. Allen of Minneapolis.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-viii-284-ix.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

WINNSBORO, S. C.—WATER.— J. Withers, City Clerk, writes: "The subject of water-works for the town of Winnsboro is now under advisement by the town authorities."

SOUTH CENTRE, KAN.—WATER.—D. W. Relihan, City Clerk, writes: "Our people are talking about voting bonds to build a system of water-works, but no action has been taken by the City Council in the matter yet."

UHRICHSVILLE, O.—Concerning the water-works miect here, our correspondent writes as follows: project here, our correspondent writes as follows: "Will rent from the Dennison Water-Supply Company, of Dernison, O. For information inquire of C. B. Street, V. P., Dennison, O."

GREENPORT, L. I.—Concerning the water project here, G. H. Corwin, the Town Clerk, writes as follows: "At a Corporation meeting held about two weeks ago the village trustees were authorized to grant a franchise for water-works to Messrs. Swain & Lovell, of Brooklyn. I understand Messrs. John Lockwood & Son are the engineers."

CHADRON, NBB. — WATER.—R. G. Dorr, Town Clerk, writes: "Chadron will vote for the issuance of \$35,000 worth of municipal bonds April 3. The proposition will carry without a doubt, and when these bonds are negotiated the system will be erected."

Towson, Mp.—The Towson Water Company will erect a large reservoir here.

COLUMBUS, O-Engineer Danenhower has submitted his report on the proposed intercepting sewer, report places the entire cost at about \$500,000.

ALBANY, N. Y.—The Board of Finance has adopted a resolution which authorizes the issuing of bonds in the sum of \$200,000 for the purpose of purchasing engines and boilers and for the erection of suitable buildaries, the employment of engineers, surveyors, and other necessary assistants.

MONMOUTH, ILL.-Water-works are to be established

SAN DIRCO, CAL.—The Mount Tecarte Land and Water Company has been incorporated here; capital, \$3.500,000; W. H. Barton and others, incorporators.

Los Angeles, Cal.—The Old Mission Land and Water Company has eeen incorporated here; capital, \$192,000; J. F. Turner, and others, incorporators.

SALEM, MASS.—H. M. Meek, City Clerk, writes us regarding an item which has been extensively published to the effect that additions were to be made to the water-works system here as follows: "Our water-works have been in operation since 1869. No steps have been taken to improve them, and no improvement is contemplated."

Franklinville, N. Y.—Our correspondent writes: "Parties have been to this place and looked at a number of springs in the locality. No other steps have yet been taken, but no doubt before long other steps will be taken and we will have a system of water-works here."

CARTERVILLE, Mo.—Water-works for this place are talked of.

Orono, Mr.-Wat-r-works are to be established here.

Washington, Kan.—Bonds are to be issued for the construction of a system of water-works here.

BATESVILLE, ARK.—It has been decided to erect a complete system of water-works here this summer.

WARRIOR STATION, ALA.—It is reported that water-works are to be established at this place. R. H. Pear-son is said to be at the head of the scheme.

WAKEFIELD, CAN.—Water-works are to be established here.

DENTON, TEX.—It is reported that a system of water-orks will be established here.

HELENA, MONT.—It is reported that plans for a sew-rage system of this place are nearly completed.

SCOTLAND, DAK.-Water-works will be established ere. The City Clerk is G. O. Sindly.

Chrtopa, Kan.—Water-works will probably be es tablished here.

| SANTA CRUZ, CAL.—Bonds in the sum of \$100 000 will be issued for the construction of a system of water-works here.

Franklin, N. H.—Water-works are to be established ere and a committee has been appointed to take prehere and a committee has been appointed to take pre-limitary steps towards the end desired.

RALRIGH, N. C — The time for opening bids for the sewer construction has been postponed until April 16.

TECUMSEH, NEB.—The opening of bids for water-orks has been postponed from March 29 to April 17.

EDGAR, NEB. - Our correspondent writes: "Water-works bonds carried almost unanimously."

New York City.—The Aqueduct Commissioners have rejected all the bids for the construction of the pipe-line from One Hundred and Thirty-fifth Street down to the Central Park Reservoir, and will give a public hearing on the subject on April 11. It appears that such a public hearing is required by law, and during the contest over the late bids it transpired that no such public hearing had been given. The work will be readvertised.

PITTSBURG, KAN.—This place has decided to establish a sewerage system and at a recent meeting of the town officials a resolution was passed making the temporary committee a permanent one, with full power to proceed in the matter. Operations are to begin at once. J. C. Merrill is Chairman of the Committee.

Orono, Me.—Water.—Albert White, Town Clerk, writes: "Company chartered and organized and are awaiting the action of the Bodwell Water Power Co. in order to ascertain if they can contract with them for a supply of water.

UNIONTOWN, PA.—Extensive improvements are to be made to the water-works here.

ASHLAND, Wis.—It is stated that several miles of additional sewer mains will be laid in this city during

MADISON, FLA.—It is reported that W. T. Davis is interested in a water-works project for this place.

MOUNDSVILLE, W. Va.—The water-works question has been settled here and the system is to be built.

WATER-WORKS.—See our Proposal Column for information regarding water-works and water-works supplies at the following places: Goderich, Ont., Goldsboro, N. C., South Boston, Va., Florence, Ala, Tilbury Centre, Ont., Tecumseh, Neb., Pittsburg, Pa., Southbridge, Mass., and Columbia, S. C.

BRIDGES.

WATERTOWN, N. Y.—A bill has passed which authorizes this town to levy a tax and borrow money for the erection of two bridges.

Sheldon, VT. - A two-span bridge was let into the river at this place by ice knocking out the pier.

WILMINGTON, N. C.—A bridge is to be erected over the Black River, near this place, by the Cape Fear and Yadkin Valley Railroad Company.

KNOXVILLE, TENN.—A bridge is to be erected over the railroad tracks in this city by the Board of Public

NEW FLORENCE, PA .- A bridge is to be built here by

the County Commissioners.

New Obtreams, La.—A bridge is to be built here by the County Commissioners.

New Obtreams, La.—A bridge is to be placed over the St. Bernard Canal. For details address J. N. Hardy, as above.

LANCASTER, O.—The County Commissioners of Fa.r-field County will erect five new bridges. Address, for details, B. F. Dunn, as above.

OQUAKA, ILL.—A bridge is to be constructed over the Mississippi at this place.

New Brunswick, N. J.—Plans have been presented to the Middlesex Board of Freeholders for a new stone bridge over the Raritan River at this place to cost \$132,000.

DEFIRIT, MICH.—It is stated that a syndicate proposes to build a winter bridge across the river at this place, the structure to have three draws, and to be torn down, so far as the superstructure is concerned, at the opening of navigation. A bill giving the necessary charter has already passed the Canadian Parliament and Congress will be asked to have the United States Engineers examine the scheme, and report whether it would be an obstruction to navigation or not.

BRIDGES.—See our Proposal Column for information regarding bridge construction at the following places: Dover, Del., Annapolis, Md., Philadelphia, Pa., Hol-ton, Kan., and Gates Centre, Kan.

GAS AND ELECTRIC-LIGHTING.

HAVELSON, MASS .- Gas works will be erected here

BRATTLEBORO, ONT.—An electric-lighting plant to cost \$20,000 is to be erected here.

EXCELSION, MINN,-Electric-light works will be erected here.

Orono, Mr.-The selectmen have been authorized to light the streets of this place by electricity.

EASTHID, MINN.—The gas com pany will creet large works during the summer season.

SALEM, MASS.—It is reported that \$36,000 has been appropriated for electric lights.

LRE, MASS.—The public streets, etc., of this place are to be lighted by electricity.

DENTON, TEX.—It is reported that gas works are to be built here.

GRAFTON, W. VA.—The Grafton Gas Company will oon erect a 60-light arc plant. CHARLESTON, W. VA.—The Charleston Gas Company has decided to erect machinery for the purpose of manufacturing water gas.

BRAUMONT, TEX.—Thomas & Gorman will erect an lectric-light plant here.

LYNCHBURG, VA.—The Lynchburg Incandescent lectric Light Co. will enlarge its plant and add ma-

CATLETTSBURG, Kv.—It is reported that an electric-light plant is to be established here, and that H Well-man is at the head of the project.

STREET-WORK AND PAVING.

Buffalo, N. Y.—Considerable discussion is going on in the Board of Aldermen concerning a "vulcanite" pavement, which is said to be, in use at Philadelphia, Washington and Pittsburg.

BIDS OPENED.

Boston, Mass.—Granite, Etc.—The Court-House Commission have received proposals for furnishing 140.000 cubic feet of dressed granite and 8,000,000 bricks and the iron frame woth necessary in the completion of the new court-house. The bid of Sampson, Clark Co. was \$264.864 and that of Augustus Lothrop \$278.888. The contract was awarded to Sampson, Clark & Co.

NEW YORK CITY.—The following bids for work in the erection of an armory building on the block bounded by the Boulevard, Ninth Avenue, Sixty-Seventh and Sixty-eighth Streets were opened March 29

enth and Sixty-eighth Streets were opened March 29 by the Armory Board:
Masonry—Moran & Armstrong, \$176,743; Luke A. Burke & Co. \$279,605; E. D. Connelly & Sons, \$168,-840; John Keleher, \$158,250.
Iron Work—Wallace Iron Works, \$77,000.
Steam-Heating and Ventilating—Rutzler & Blake, \$11,976; Baker, \$mith & Co., \$12,848; Jacob Jamer, \$12,471; James Curran, \$11.870.
Plumbing and Gas Fitting—George Cody, \$12,000; John Renehan, \$12,000; James Armstrong, \$11,737; P. I. Andrews, \$14,300; Isaac A. Shumway, \$12,125; Christopher Nally, \$12,095; Mead & Rossman, \$12,500; John Sullivan, \$10,000.
The board returned to the architect the plans and

500; John Sullivan, \$10,000.
The board returned to the architect the plans and specifications, with instructions to bring the total cost within the appropriation of \$300,000.

ALBANY, N. Y.—Paving—The contract for paving Norton Street with granite blocks has been awarded to Jacob Holler, and that for paving Canal Street, from Lark Street to Lexington Avenue, to A. N. Brady.

NRW YORK CITY.—The following was the only bid or building additions to paythons B, C and D, and ining-room and kitchen A at Central Islip, L. I, by ne Department of Charities and Correction, and pened March 31: W. S. Velsor, \$12,737.

ALBANY, N. Y.—The following bids for building ALBANY, N. Y.—Inc following bids for building new reservoirs, gate houses, etc., were opened March 29 by the Special Water Commission: Jacob Holler, Albany, \$375,127,59; Sullivan & Ehlers, Albany, \$421,-015,50; Houlthan & Flaglet, Cohoes, \$485,628.83; John H. O'Rourke, Brooklyn, \$490,357.92; Crawford & Valentine, Brooklyn, \$271,594.

VANKTON, DAK.—The contracts for building the additional wings to the South Dakota Insane Hospital have been awarded by the Board of Trustees as follows: W. Wallace & Son, Canton, Dak., for excavating and stone-work of both basements, \$10,400; J. B. Pattee. Canton, for completing the wings above the basement, \$58,500.

Chicago, Ill.—The following bids for pumping machinery, etc., were received by G. B. Swift, Esq., March 31:

	Quinta New	Henry	Edward	
	Quintard Iron Works, New York	Henry R. Worthington, 1 5	Edward P. Allis & Co., Milwaukee, Wis 5	Dip Dip Dip Dip Dip Dip Dip Dip Dip Dip
1A *	80.	261/2	27.	High-pressure cylinder.
150 pou	. %et	ts,	*	Intermediate cylinder.
* At 150 pounds steam pressure	56.	42° 2-51° 2-57%	70.	Low-pressure cylinder.
m pr	96.	8,	8,	Stroke of engine.
essur	ω .	++	ω	Number of single- acting pumps.
.*	261/2" 256' 22 57"	34 110 23	32%.	Diameter of plunger.
	256'	110	162	Piston speed.
_	25	23	5	Number of boilers.
Ä	57*	26°	62.	Diameter of boilers.
120 P		16 18 18 18	20	Length of boilers.
ounds	16' 38-4.	12-1	3234" 102' 15 62" 20' 40-4"	Number and size of tubes.
iteam p	} 110d	137	125	Million pounds duty guaranteed.
At 120 pounds steam pressure.	formal). 110* \$625,000		\$360,785. Plan B.	Тотац

LAPBER, MICH.—The following bids for construct-a complete system of water-works were opened March 24 by the Water Board:

Complete Works—W. S. Parker & 'Co., New York,

Complete Works—W. S. Parker & 'Co., New York, \$19,446.
Complete except wells and engine houses—W Walker Port Huron, Mich., iron, \$14,856; kalamein, \$34,-600; Lansirg Iron and Engine Works. Lansing, Mich., \$38,000; Geo. C. Morgan, Chicago, Ill., iron, \$39,679; kalamein, \$42,519; wood, \$50,266; Rhied Bios., Lapeer, Mich., \$35,739.
Pumps and Boilers—W. Walker, Port Huron, three bids. \$4,000, \$4,700, \$5,200; Michigan Pipe Co., Bay City, three bids on wood pipe, \$4,200, \$5,300 \$7,200; Lansing Iron and Engine Works, \$5,354; Deane Steam Pump Co., Holyoke, Mass., \$8,100.
Hydrants—W. Walker, \$2,800.
Gates—W. Walker, \$2,800.

Gates—W. Walker, four bids, \$8.50, \$13.70, \$20.50, \$28.

Special costings — W. Walker, \$2.50; National Foundry and Pipe Co., Scottsdale, Pa, \$3; Detroit Pipe and Foundry Co., Detroit, Mich., \$2.30.

Iron Pipe, per ton—W. Walker, \$28.15; National Foundry and Pipe Co., Scottsdale, Pa., four bids, \$31.67, \$31.42, \$31.7, \$30.62; Detroit Foundry and Pipe Co., Detroit, Mich., \$28.

Complete pipe, hydrant and gate system—Dennison & Coinell, Muscatine, Iowa, \$31.050; Michigan Pipe Co., \$25,644.50; National Tube Works, Chicago, Ill., complete, with kalamein pipe, \$30,000.

Boilers—Lansing Iron and Engine Works, \$1,300; Gordon & Maxwell Pump Co., Hamilton, O., \$1.875.

Pumps—Gordon & Maxwell Pump Co., five bids, \$2,500, \$2,500, \$3,150, \$3,600, \$3,750.

\$2,500, \$2,800, \$3,150, \$3,600, \$3,750.

ST. PAUL, MINN.—The following contracts have been awarded by the Poard of Public Works:
Sewers and Pavements—Grading Seventh Street, from Phalen Street to White Bear Avenue, to A. O. Oleson for \$21,310; sewer on Maple Street to G. Moline and others for \$1,124 82; grading Forest Street, from Mcl.ain to Seventh Street, Hastings Avenue, from Plum to English Street, sewering Hastings Avenue, from Plum to Earl Street, Forest, from Hastings Avenue to Fourth Street, point Doug'as Street, from Earl to Maple Street, and Mendota Street, from Hudson to Frances Street, to McArthur Bros. for \$54,000 paving Vir, inia Avenue with brick to James Forrestal for \$16,400. All bids for sewers on Warsaw, Goodhue, Dawson, Leech and Oneida Streets were rejected.

ST. PAUL, MINN.—Contracts have been let by the Board of Education as follows: Humboldt School, \$50,000, to Armit & Co; new school building, \$32,000 to contractor Rundle.

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NEW YORK CITY.—The following bids for lighting the streets, etc., of this city for the term of one year, commencing May 1, were opened March 26 by the Gas Commission:

the streets, etc., of this city for the term of one year, commencing May 1, were opened March 26 by the Gas Commission:

Consolidated Gas Company, \$17.50 per lamp; New York Mutual, \$17.50; Equitable, \$12; Central, \$28; Northern, \$29; Yonkers, \$29; New York and New Jersey Globe, \$25. The latter company will supply naphtha gas at \$21.50 for 1,000 lights, \$23.50 for 500, or \$23.50 for 300 in the district now lighted by the Yonkers Gas Company. The Brush Electric Illuminating Company, 392 lights at 44 certs each per night; \$2 at 39; \$6 at 40, and 17 at 47. The United States Illuminating Light Company, 5 lights at 41 cents each per night; 38 at 44; 10 at 42; 13 at 47, and 340 at 49. The Harl m Light Company, 207 lights at 30 cents each per night; 20 at 40; 124 at 42; 38 at 41; 12 at 45; 10 at 50, and 15 at 60 cents each. The Mount Morris Electric-Light Company, 87 lights at 32 cents each per night; 143 at 39, and 80 at 40. The Ball Electric-Light Company, 72 lights in Sixth Avenue and Broadway, between Twenty-third and Fifty-ninth Streets, at 50 cents each per night. The East River Electric-Light Company, 162 lights at 38 cents; 254 at 50 and 21 at 42½. The North New York El-ctric-Light Company, 370 lights at 38 cents; 254 at 50 and 21 at 42½. The North New York El-ctric-Light Company, 370 lights at 7 cents each per night.

No awards were made, but the matter will be further considered at a meeting of the Commission to be held in a few days.

WATERBUY, CONN.—The following bids for constructing sewers were received by F. Floyd Weld, City Engineer, April 4, 1888:

*Awarded contract.	R. I., Bronson and E. F. Judd, Waterbury, Conn	. Bippers.
	\$8.82 7.40 10.09 9.00 7.90	45" Brick Sewer, 190 lin.ft.
	\$6.86 6.25 10.19 9.50 8.40	36" Brick Sewer. 280 lin. ft
	3.65	20° vit. pipe. 3,600 lin. ft
	\$4.25 4.15 2.79 2.50 2.35	18" vit. pipe. 1,100 lin. ft.
	\$3.37 1.40 1.50 1.50	12° vit. pipe. 120 lin ft.
	93.03 0.83 1.25	8" vit. pipe. 330 lin. ft.
•	\$6.75 4.45 5.49 5.20	24" cast iron pipe. 12 l. f.
	\$6.25 6.20 5.11 5.00 4.25	20" cast-iron pipe. 600 l. f.
	\$5.75 4.50 3.07 4.00 2.95	16" cast-iron pipe. 70 l f.
	2.25 2.30 3.00	12" cast-iron pipe, 70 l, f,
	\$5.00 1.50 2.19 2.50 1.95	ro" cast-iron pipe, 481, f.
	\$4.75 2.30 1.01 1.75 1.75	8" cast-iron pipe。 120 l. f
	\$35 60 41 50	Manholes. 30.
	\$477 260 447 610 725	Outfall chamber. 1.
	\$168 170 150 250	Terminal chamber. 1.
	j	Well. 1.
	\$221 \$33,958.90 400 29,949.90 305 26,019.40 300 25,414.50 460 23,471.00	Total.

Also received, same date, bids for 9,400 square yards of granite, dimension block paving, as follows:
Edward McMauus, Waterbury, Conn., \$1,25 per yard; Charles Jackson & Son, Waterbury, Conn., \$2,02; R. L. Bronson, Waterbury, Conn., \$2,82; Theodore A. Madden, Bridgeport, Conn., \$2,27; John H. Brown, New London, Conn., \$2,73; Leonatd W. Johnson, New York, N. Y., \$3,49; C. W. Blakesiee & Sons, New Haven, Conn., \$2,60.

The contract was awarded to C. W. Blakeslee & Sons, Sons,

NEWARK, N. J.—PIPE.—The Aqueduct Board has awarded the contract for furnishing the amount of 16 and 12 inch pipe and special catings required to make the Twelfth Ward extension, also for furnishing 20,000 feet of 6-inch pipe, to the Mellert Foundry and Machine Company, of Reading, Pa., at the following, prices: 16 and 12 inch pipe, \$26.65 per ton of 2,240

pounds; special castings, 2½ cents per pound; 20.000 feet of 6-inch pipe, \$27 per ton of 2,240 pounds delivered in Newark.

LITTLE ROCK, ARK.—STREET-LIGHTING.—The City Council has closed a contract with the Fort Wayne Jenny Electric-Light Company for an electrical apparatus to run four electric-light towers and ninety arclights, at a cost of \$27,000.

LOUISVILLE, Ky.—Machinery—Boilers—The follow-ing proposals for pumping engine machinery and boilers, all complete, were opened April 2 at the Water Company's office:

ompany's omce: Quintard Iron Works, N. F. Palmer, Jr., & Co.,

Quintard Iron Works, N. F. Palmer, Jr., & Co., \$265,000.
J. P. Morris Company, of Philadelphia, \$235,000.
The proposal of the latter company was accepted.
The proposals for engine house and engine foundations and caisson complete were as follows: W. M. Patton, \$253,050.02; Shaanhan, O'Connor & Co., \$236,582.50; Donaid McDonald, \$223,508.85; Sooy Smith Company, \$762,280.55.
The proposal of the Sooy Smith Company was accepted.

cepted.

The bids for inlet and river work were as follows:

W. M. Patton, \$17,903; Shanahan, O'Connor & Co.,
\$18,000; Donald McDonald, \$18,776.55; Sooy Smith
Company, \$9,000.

Company, \$9,000.

The proposal of the Sooy Smith Company was accepted.

GOVERNMENT WORK.

LOUISVILLE, KY.—STONE.—Abstract of proposals for furnishing stone for lock at Beattyville, Ky., opened March 3 by Major Amos Stickney, Corps of Engineers, U. S. A.: Wendell P. Curtis, 1800 cubic yards, dressed face, per cubic yard, \$16.93; 1,500 cubic yards, quarry face, per cubic yard, \$14.45; 1,301 yards squared stone, per cubic yard, \$11.93.

FORT WAYNE, IND.—The following bids for interior finish of Court-House were opened April 3 by the Supervising Architect of the Treasury Department: Corbett & Van Horn, Washington, D. C., \$23,563; McCarthy & Baldwin, Washington, D. C., \$23,563; John O'Connor, Buffalo, N. Y., \$27,802.50; Shover & Christian, Indianapolis, \$27,955; J. W. & T. G. Rubinson, Cincinnati, O., \$29,480.

WASHINGTON, D. C.—The opening of bids for stone or the Congressional Library building, which was to ave taken piace March 3t, has been postponed until April.

The bids for torpedo boats, which were to have been opened April 1, will not be opened until May 1.

NEW CORPORATIONS.

The Dougherty Cable Traction Company, Harper's Ferry, W. Va. Capital, \$500,000. M. Lippman and others, incorporators.

The Interstate Construction Company, East St. Louis, Ill. Carital, \$800,000. James Campbell and others, incorporators.

The Woodland Street Railway Company, Woodland, Cal. Capital, \$30,000. Thomas Ross and others, incorporators.

The City Railway Company, New York, N. Y. Capital, \$1.000,000. W. W. Cryder and others, in-

THE Wichita, Meade Centre and Western Railway Company; capital stock, \$1,000,000. Directors, O. B. Hamilton, M. J. O'Mara, and others.

MISCELLANEOUS.

Indianapolis, Ind.—Bids will soon be wanted for the foundations for the Indian Soidiers' Monument to be erected here at a cost of \$200,000 Fred. Baumann, of Chicago, Ill., has been appointed supervising archi-

PROPOSALS.

(Centinued from page viii.)

NOTICE TO CONTRACTORS.

Postponed on account of High Water.

SEWERS.

CITY OF MONTGOMERY, ALA., (April 3, 1888.)

April 3, 1828. April 3, 1828. SEALED PROPOSALS will be received at the office of the City Clerk until 6 o'clock, April 16, 1828, for the construction of the Central Division of the general system of sewers and appurtenances, containing about as follows, viz:

7,916 " " 8" "
45 manholes, six of which will be rigged for flushing.
A twenty thousand dollar bond will be required for the faithful performance of the contract and five hundred dollars must be deposited with the City Clerk with each bid.
Plans and specifications can be seen at the office of the City Eugineer. Blank forms of proposal will be furnished upon application. Work to be commenced fifteen days after the contract is executed.

Flans and particular the City Engineer. Blank normal furnished upon application. Work to be commence fifteen days after the contract is executed.

W. S. REESE, Mayor.

By W. G. WILLIAMSON, City Engineer.

APRIL 4. 1888.

APRIL 4, 1888.

SEALED PROPOSALS will be received at the office of Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 20th day of April, 1388, for the materials required for the completion of the masonry work of the Post-Office, Court-House, etc., at Augusta, Me., above second floor beams, to be delivered at the building as required and in accordance with the specification and drawings, copies of which may be seen at this office, at the office of the Superintendent, the Master Builders' Association. Boston, Mass.; Knights of Labor office, Concord, N. H.; Mechanics' and Traders' Exchange. New York City, and the Builders' Exchanges at Albany, N. Y., and New Haven, Conn. Each bid must be accompanied by a certified check for \$500. WILL. A. FRERET, Supervising Architect.

PROPOSALS.

TORPEDO BOAT.—WASHINGTON, D. C. -Proposals are wanted, until May 1, for the construc-tion of a sub-marine torpedo boat. Address William C. Whitney, Secretary of the Navy, as above.

WATER-WORKS.—Proposals are wanted at Tecumseh, Neb., until April 17, for a complete system of water-works. Address P. A. Brundage, City Clerk.

WATER-PIPE.—Proposals are wanted at Pitts-burg, Pa., until April 16, for furnishing and delivering 896 tons of water-pipe and 22 tons special castings, ac-cording to specifications. Address E. M. Bigelow, Chief of Department of Public Works.

BOILER AND ENGINE. - Proposals are wanted at New York City until April 7, for new boiler and engine for steam launch "William H. Wickham." Address the Department of Charities and Correction, 66 Third Avenue.

RESERVOIR DAM.—Proposals are wanted at Southbridge, Mass., until April 14, for the building of a reservoir dam, according to specifications. Address A. C. Moore, Engineer, as above.

RESERVOIR, COLUMBIA, S. C.—Proposals are wanted until April 9 for building a reservoir. Address William J. Cathcart, as above.

GRADING AND RAILS.-Proposals are GRADING AND RAILS.—Proposals are wanted at Cleveland, O., until April 19, for grading and Medina block paying on earth portions of Central Viaduct; also for funnishing about 2,850 feet of double track street railway on the 100 portion of viaduct—Johnson's girder steel rails. Address Walter P. Rice, City Knomer.

BUILDINGS.—Proposals are wanted at New York City until April 13 for two groups of buildings, each consisting of three pavilions, with dining-room attached, at Central Islip, Long Island, N. Y. Address the Department of Charities and Correction, No. 66 Third Avenue, as above.

PAVING.—Proposals are wanted at New York City, until April 11, for taking up and relaying the pavement now in s-veral streets. Address the Department of Public Works.

WATER-WORKS.—Proposals are wanted at Til-bury Centre, Ont., until April 25 for the construction of water-works. Address A. A. Wilson, Village Clerk, as above.

STONE.—Proposals are wanted at Philadelphia, Pa., until April 27 for furnishing and delivering stone on the dike, in the Delaware River, near Mifflin Bar. Address Henry M. Robert, Lieut.-Col. of Engineers, U. S. Army, as above.

DIKE.—Proposals are wanted at Philadelphia, Pa., until April 27 for constructing a dike in the Delaware River, near the lower end of Reedy Island. Address Henry M. Robert, Lieut.—Col. of Engineers, U. S. Army, as above.

IRON BRIDGE.—Proposals are wanted at Holton, Kan., until April 13 for the erection of an iron bridge according to specifications. Address Ed. E. Birkett, County Clerk, as above.

BRIDGE.—Proposals are wanted at Gates Centre, Kan., until April 23 for the construction of a bridge according to specifications. Address Henry Porter, Bridge Commissioner, as above.

(Continued on page ix)

Building Intelligence.

WR solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Appropriations—A brown stone: for, brick: for st.

BREVIATIONS.—b s, brown stone; br, brick; br st, brick store; hs dwell, brown-stone dwelling; apart house, apar hent-house ten, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

N w cor Park av and 82d, br flat; cost, \$22,000; o, Moore & McLaughlin; a. Thom & Wilson.

N s82d, 35 w Park av, 2 br flats; cost, \$56,000 all; o and a, as above. N w cor 115th and Madison av, 2 br flats; cost, \$70,-000 all: 0, Jas I) Johnston; a, Geo Keister

124 West 24th, br stable; cost, \$18,000; o, Alfred P Darling; a, D & J Jardine.

11 East toth, br flat; cost, \$20,000; o, Wm H Russell; a, Renwick, Aspinwall & Russell.

123-125 E 20th, 2 br flats; cost, \$46,000 all; o, Loonis & Parker; a, Eugene Parker.

Se cor Third av and 156th, 5 br tens; cost, \$74,000 all; o, E R Robinson; a, DeLemos & Cordes.

S s East Broadway, 48 e Catharine, br stores; cost, \$14,000; 0, John J Martin; a, Wm Graul.

2,169 Second av, br tens; cost, \$20,000; 0, Jonar Wei and Bernard Mayer; a, Geo B Pelham.

7 Jones, br ten; cost, \$20,000; o, Daniel Halley; a, M V B Ferdon.

S w cor Bedford and Downing, br ten; cost, \$22,000; o, Alexander and Martha A Jansen; a, M V B Ferdon. 42-44 E 84th, br dwell; cost, \$40,000 all; o, Sisters of Charity of St Vincent De Paul; o, Wm Schickel & Co.

12 St Mark's pl, brick club house; cost, \$28,000; 0, Deutsche Am Schutzen Gesellschaft; a. W C Frohne. 255-257 Greenwich, 2 br bldgs; cost, \$10,000 each; 0, estate Geo W Walsh; a, J E Ware.

3d av, s e cor 34th, br and stone flat with stores; cost, \$40,000; o, Geo R Read; a, Basset Jones.

352 E 20th, br dw with stores; cost, \$7,500; o, C Boylan; a, Joseph Wolf.

North ad av. e s. 200 s Pelham av. r brick flat with stores; cost. \$15,000; o, J B Haskin; a, A B Marshall; b, M Montague.

W s 4th av, 50 s 91st, 2 br dws and stores; cost, \$28,000 all; o, K A Thomas and Wm H Hall; a, Cleverdon
& Putzell.

BUILDING INTELLIGENCE.

NEW YORK CITY-Continued.

53 Willett, br dw and store; cost, \$16,000; 0, Ačiz Mosback: a, Geo Heidtfelder.

260-264 Stantan, 3 br dws; cost, \$40,000 all; 0, Jatus H Zimmerman; a, Rentz & Lange.

95 Macdougal, br ten; cost, \$16,000; o, John J Fer. han & Ernest Hammor; a, Rentz & Lange. N e cor Centre and Leonard, br shoe factors: C.K. \$50,000; o, Solomon Loeb; a, De Lemos & Cords.

Sw cor Webster av and 179th, 9 fr semi-detached cottages; \$16,975 all; 0, Elliot Fitch Shepard; a, Care & Hastings.

02 Hester, br shop; cost, \$8,000; o, M Lendon, a. Rentz & Lange.

ALTERATIONS-NEW YORK

ist av and St Mark's pl. br ten; cost, \$7,000; o, $L_{\rm D}$, pold Adler; a, Berger & Baylies, 137-143 2d, br dws; cost, \$20,000; o, Sisters of & Dominick; a, Wm Schickles & Co.

205-207 90th, br factory; cost, \$30,000; 0, FS Mrss a, G H Beedlong.

46 Pine, n e cor Pine and William, brick office bet cost. \$130,000; o, Commercial Assurance Co; a, G. Harney.

S s 125th, 50 w 7th av, br hotel; cost, \$55,000; 0, Alex S Walker; a, Theo S Thompson.

BROOKLYN.

Garfield pl, s s, 170 w 8th av, 5 b s dws; cost, to a \$52,500; o and b, John J Campbell; a, W M Costs. Es Bushwick av, 94 s Troutman st, 2 fr dws; cos \$10,000 all; o, Peter Eisemann; a, Th Engelhard.

S s Quincy st, oo e Stuyesant st, 2 h Engradu. \$18,000; 0, John F Weige: a, same as above a, same as above.

W s Nostrand av, bet Prospect and Park pl, 2 b: ds; cost, \$9,500 all; o, S E Lowther; a, J W Glover. W s Nostrand av, bet Prospect and Park pl, 8 brdss. cost, \$72,000 all: 0 and a. same as above.

W s Nostrand av, s w cor Prospect pl; also n word same, 2 br dws; cost, \$19,700 all; o and a, smess above.

283-87 Devoe st. 3 fr dws; cost, \$10,500 all; 0. Mn Mary A Kunz and Sebastian Zentgraf; a, F J Belebach. N e cor 7th av and 7th st, br dw and store; cost, incoo; o, A G Calder; a, W M Calder.

789 Flushing av, br dw and store; cost, \$6,000; s.A. D. Wellbrook: a, Th. Engelhardt.

S s Vernon av. 240 e Lewis av. 3 br dws; cost, \$2.00 all; o, Henry Grasmann; a, Frank Holmberg. Es 7th av, 40 e 7th st. 3 br dws; cost, \$27,000 all; a. A G Calder; a, W M Calder.

S e cor Franklyn and Dupont sts, 2 br dws; cos, \$15,000; o, John D Wacker; a, A Herbert.

E s 7th av, 21 s 7th st, br dw and store; cost, \$9,000; o, A G Calder; a, W M Calder. o, A G Caider; a, W M Caider.

S w cor Fulton st and Kingston av, br dwardsce.
cost, \$15,000; o, Peter Alsgood: a, Carl F Eisensch.
21st and Washington, br brewery; cost. \$6,000.6.
Her & Bergomeyer.

77 bldgs costing less than \$7,000

ALTERATIONS-BROOKLYN.

Stagg and Ten Eyek sts. br armory, cost, \$85,500 A. County of Kings; a, W A Mundell. ro Lee av, br dw; cost, \$10,000; o, August Walking a, Wm C Frohme.

MISCELLANEOUS.

MILLVILLE, N. J.—A Presbyterian church, to cost \$15,000, 's to be erected here.

ST. PAUL, MINN.—The St Paul Fire and Minte Insurance Company will erect a large office builder with rao feet front on Third Street at the coract st Jackson.

MONTGOMERY, MASS.—3½-story summer high, 38x125 feet; cost, about \$13,000; 0. A M Butteriet, a, Richmond & Seabury, of Springfield; b, coarse not let.

MINNEAPOLIS, MINN.—About \$4.000 will be co-pended at the motor station on Lake Harriet in a summer garden and theatre.

WEST SUPERIOR, WIS .- The Land and River in provement Co will erect a \$75,000 dock here. CHATFIELD, MINN.—The city will expend \$150000 on a public school building.

NEENAH, WIS.—\$100,000 is to be expended in school buildings.

ABERDEEN, DAK.—Presbyterians will build a \$15,000 church.

SPOKANE FALLS, W. T.-Menteeth & Seitenbech will put up a \$100,000 business block.

NEW RICHMOND, WIS.—The Y M C A are to erect a building.

MIDDI.EBORO, MASS.—The Baptist Society # 11 erect a church to cost \$18,000 here.

KANSAS CITY, MO.—Maple av. near Ind ave. by dwell; cost, \$10,000; o, J & Gunnotte.

1105-117 Broadway, br dwell; cost, \$15,000; 0. JR Stark. Central, cor 15th, br dwell; cost, \$15,000: 0, Pa Soden.

HUTCHINSON, KAN,—Carter & Woodruff, architects are preparing plans for a business block to com Opera house; cost, \$80,000; located on Sherman

John McAdams will erect a \$20,000 residence.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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FILTER-GALLERIES AND COVERED RESERVOIRS.

WE print on another page an abstract of a part of the report of the Engineer of the Massachusetts State Board of Health upon matters connected with the water-supplies of the State, and we wish to call the attention of those who are interested in such matters to that portion which relates to the effect of filter galleries on the water of ponds in the immediate vicinity.

In the particular case reported by Mr. Stearns, the evidence of the chlorine determinations is sufficient to show that the water obtained from a filter-gallery distant 130 feet from the shore of a pond was in part derived from that pond. The changes in the water produced by this filtration are very marked. The sediment, turbidity, color and odor are almost entirely removed, and the free and albuminoid ammonia are greatly diminished. The filter-gallery water contains about one-tenth as many bacteria per cubic centimetre as are found in the pond. All the algæ of the pond were filtered out by the time the water had reached the filter-gallery.

Mr. Stearns concludes that in many instances a supply of water may be obtained from a bed of porous gravel adjoining an unfailing pond or stream, and that the water so obtained will probably be purer, cooler, and better in its commercial and sanitary aspects than the water taken directly from the pond or stream.

It does not follow that the results will be good when the filtering layer is thin, nor can such filtration be relied on to purify seriously polluted water.

Mr. Stearns in his report also calls attention to the fact that certain waters deteriorate by storage in open reservoirs, that this seems to be due to the growth of certain forms of vegetation, and that this may be prevented by the exclusion of light. This was tried in the case of the high service tank at Brookline with very satisfactory results.

In close connection with the reports of the Board of Health upon water-supplies is an interesting paper on the odor and color of surface waters, by Dr. T. M. Drown, which was read before the New England Water-Works Association at its meeting in Boston last December.

Dr. Drown has had charge of the chemical analyses of waters made for the State Board of Health in the Massachusetts Institute of Technology, and this paper may be taken as a preliminary sketch of a part of a more extended report to be made hereafter. As regards odor, he points out that the peculiar odor developed in some instances when the water is rapidly heated, and which he terms the "hot odor," is very different from the odor of the same water when cold, and is significant of certain forms of dissolved or suspended organic matters.

The difficulty of describing these odors, or of establishing anything like a scale of comparison which will be significant to others, is very great. Dr. Drown uses the qualitative terms "earthy,"
"straw-like," "moldy," "musty," "disagreeable," "offensive," and "peculiar," but it would probably be necessary to visit his laboratory and compare samples to learn the precise sense in which each of these is used. His color-scale is more easily worked. It consists of a series of thirty formed with nearly consists of a series of

in diameter and twelve inches long, the water standing nine inches high in the tube. Tint No. 1 is produced by Nesslerizing one cubic centimetre of the standard ammonium chloride solution containing o.oooo1 gram of ammonia; tint o.1 is produced by one-tenth of a cubic centimetre and tint No. 2 by two cubic centime-The relation between color intensity and the amount of albuminoid ammonia present appears to be tolerably close, but further investigation is needed on this point.

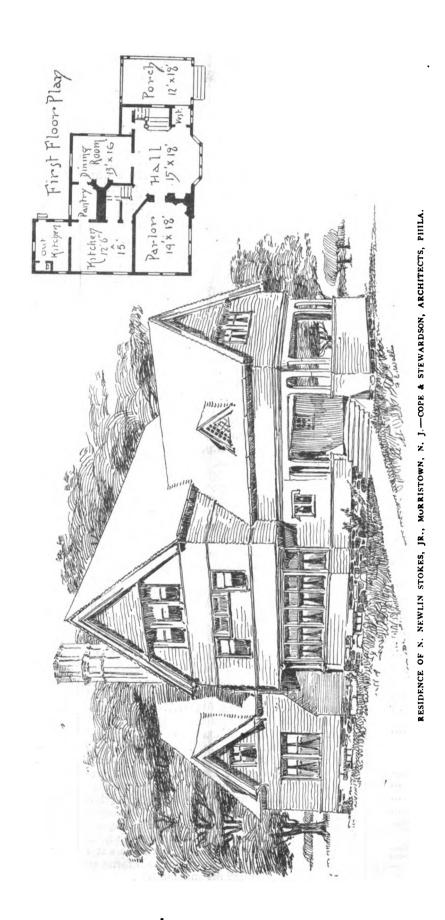
ACCIDENTS IN MINES.

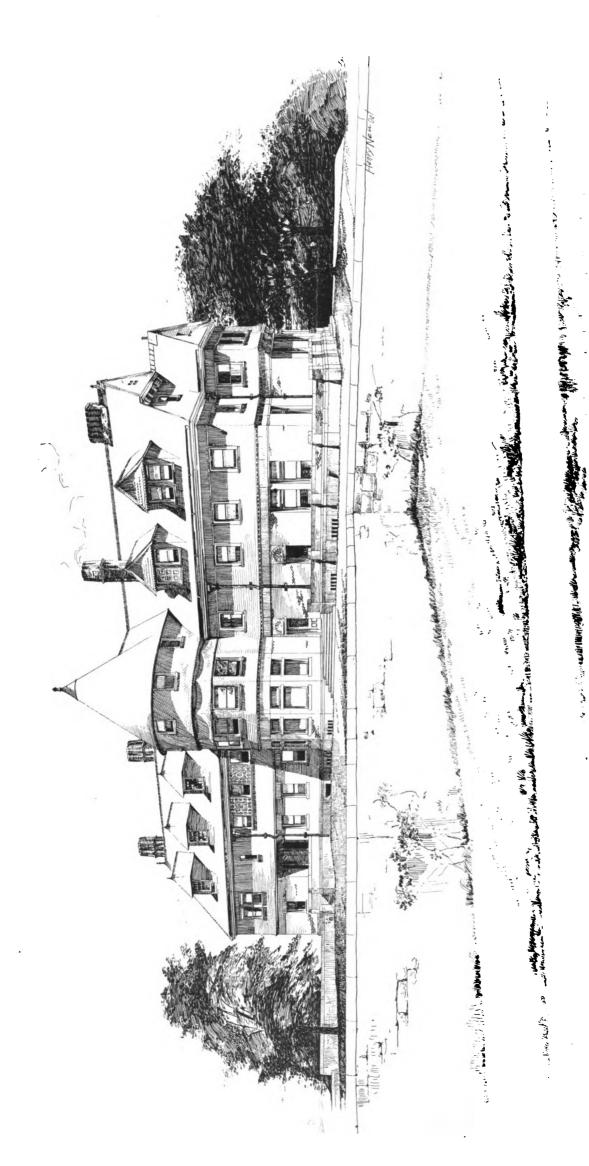
THE paper on "Accidents in Mines," by Sir Frederick A. Abel, read before the Institution of Civil Engineers in May, 1887, with an abstract of the discussion which followed, has just been issued as an excerpt from the Minutes of Proceedings, forming a volume of 196 pages octavo, which contains much matter of interest to mining engineers, and especially to those interested in the practical operations of coal mining. It is true that the paper has a much more limited scope than its title indicates, since it is mainly devoted to the subject of explosions in coal mines, with some references to accidents connected with hoisting machinery and falling in of roofs of galleries, etc.; but the subject of explosions alone, involving, as it does, the whole subject of the lighting of mines and that of various forms of explosives, is of great import-

The theory that explosions may be due to the presence of large quantities of fine coal-dust in the air, and that such an explosion may be as violent and as destructive as a fire-damp explosion, appears to be now generally accepted, in part on direct experimental evidence and in part because it is almost impossible to account for certain explosions which originate in and follow the intake of the ventilating air galleries, upon the supposition that they are due to explosible gas mixtures.

This has led to the use of means for moistening the air and laying the dust in the form of water sprays, steam jets, etc. One instance was cited by Mr. T. Forster Brown, in which in a large colliery an extensive line of water-pipes was laid along the main haulage roads having outlets giving off fine spray at intervals of forty yards, with the result of dampening the dust and reducing the temperature in a very satisfactory manner.

As yet there does not seem to be any thoroughly satisfactory form of miner's lamp, and the tendency seems to be to seek some form of electric illumination for the purpose. The use of water to surround a blasting charge of a high explosive, forming what is called a "water cartridge," is insisted on by Sir Frederick Abel, in part as a safeguard against accidental ignition of dust or gas mixtures and in part to distribute the force of the charge so as to avoid a crushing action in the immediate vicinity and produce work in bringing down or loosening coal over a large area. The rule which he gives is that the large area. The rule which he gives is that the quantity of water should amount to at least four times the volume of the charge of explosive. In speaking of the difficulty of detecting small amounts of fire-damp, the author considers that the best instrument for this purpose is the fire-damp indicator of Mr. E. H. Liveing, in which tints formed with varying amounts of ammonia by the Nessler reagent, the comparison being made in Nessler tubes three-quarters of an inch





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

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electric current, is photometrically measured and accurately indicates the amount of fire-damp in the air. This instrument will indicate the presence of fire-damp or marsh-gas when it amounts to only 0.25 per cent_ of the air tested. Of the deaths due to various causes in English coal mines from 1875 to 1885, a little over 23 per cent. were due to explosives, 40 per cent. to falls of roof and sides, and the remainder to miscellaneous caus es.

The greatest improvement which has been made in protecting the lives of miners seems to have been made in the machinery in the shafts. The average of shaft accidents during the ten years 1850-60 was one death to each 1,161 persons employed; during the next ten years it was one to 2,121, while from 1871-80 it was only one

to 3, 557.
The various forms of safety-clutches and safetyhooks to be used in connection with the cages and lifts do not seem to obtain general approval, and it would seem as if none of them were a cerprotection against a drunken or careless tain engi meer, yet that will not account for the removal of su chapparatus from many shafts, since it would seem that it might be occasionally useful, though not a certain preventive. We should be glad to obta in data for an account of the safety devices used in mines in this country and an estimate of their practical utility.

NELY YORK BENEFITED BY RIVER AND HARBOR IMPROVEMENTS ELSEWHERE.

T == E attention of those New York papers which are isposed to make light of the improvements of r avers and harbors in the South Atlantic States is invited to the following letter received from Col. William P. Craighill, U. S. A., which presents another argument for rational consideratior on the part of our metropolitan dailies of the matter of river and harbor improvements elsewhere than around New York Harbor. The following is his letter:

U. S. Engineer's Office, Baltimore, Md., April 11, 1888.

SI=: I have this moment read with much satisfaction your -editorial of April 7. Selt-interest is a powerful telescope through which to see at times, but in this case the Sun must have been dazzled by its own light to such an exten t as to not perceive that every commercial developon the Atlantic coast is more or less in the interest of New York City, the great financial heart of the country.

Ca ptain Bixby has shown clearly the importance of the minor improvements he referred to. While each may be comparatively small by itself, their aggregate makes a large volume, the effect of which is immediately felt by their local commercial centres-Charleston, or Savannah, or W ilmington, etc. Experience has shown that any importa_nt commercial development at such a local centre is immediately followed by a new steamboat line to New York - City, or by some other successful effort for increased -ction with that great centre.

W. P. CRAIGHILL. Yours respectfully,

O ARCHITECTURAL ILLUSTRATIONS.

RESI ENCE OF WILLIAM F. WELD, ESQ., BROOKLINE, -ASS. -WHEELWRIGHT & HAVENS, ARCHITECTS.

this building North River stone is used for underpiani ____g. Perth Amboy brick for wall of first story, with =rst stone trimmings; shingled second story, gables and roof. Interior, quartered oak; hall and drawingenameled white paint and gold; library and diningroom _ quartered oak. The principal bedroom finished in room . woods or enameled white. hard -

The architects were Wheelwright & Havens, Boston, Mass.

RESIDENCE OF N. NEWLIN STOKES, JR., MORRISTOWN. N. J. COPE & STEWARDSON, ARCHITECTS.

The first story is of stone; shingles above and shingle roof. Interior finish: first story, oak; second story, chest third story, white pine, varnished. The archiere Cope & Stewardson, Philadelphia.

EXAMINATIONS OF WATER-SUPPLY IN MAS-SACHUSETTS.*

BEGINNING the 1st of June, 1887, every public watersupply in the State was visited and examined by the engineer or one of his assistants, places for taking samples of water were chosen, and the methods to be followed were explained to those who were to take them.

explained to those who were to take them.

But few more than one-third of the whole number of cities and towns in the State have a public water-supply, yet the total population of the places supplied represents 82 per cent. of the population of the State. This estimate of population represents the whole number of persons in the municipalities supplied, and is consequently slightly in excess of the number of persons who can avail themselves of a public supply. There are but three towns having a population exceeding 4.500 that are not supplied, and where the population exceeds 3,500 the majority are supplied, while below this limit the reverse is true.

There are in the State 123 sources of public water-supply as follows: Ground water sources—springs, 16; large

ply as follows: Ground water sources—springs, 16; large wells. 16; tubular wells, 7; filter galleries, 7; filter basins, 4; total, 50. Surface water sources—artificial storage reservoirs, 36; natural ponds, 32; streams, 5;

The line of separation between the different classes is somewhat indefinite. A filter gallery or well on the banks of a stream may each furnish water of identically the same character, while another well may furnish the water of a natural spring which it has replaced. Natural ponds, by having their level raised, may flow extensive meadows, and so become less satisfactory reservoirs than meadows, and so become less satisfactory reservoirs than those that are wholly artificial. Tubular wells are frequently sunk in the bottoms of large wells or filter basins with the view of increasing the supply of water.

The thirteen cities having a population of more than 25,000 each all get their supply from surface sources.

Of the 23 cities in the Commonwealth, 20, having a total population of 1,030,282, own their own water-works, while 2 having a total population of 57,214, are wholly

total population of 1,030,282, own their own water-works, while 3, having a total population of 57,214, are wholly supplied by private companies.

Of the 103 towns having a public water-supply, 50, having a total population of 285,086, are supplied from their own works, and 53, having a total population of 222,796, by private companies. The total population of the cities and towns owning their own works is 1,315,368, against 280,010 for those supplied by private companies.

280.010 for those supplied by private companies.

About 200 samples of water collected from the existing water-supplies of the State, and from 36 places on 17 water-supplies of the State, and from 36 places on 17 rivers and ponds, are received monthly at the laboratory, in addition to a varying number collected as occasional specimens from other places or in connection with special investigations of new sources of existing works. Daily records of the temperature of the water at 50 places, and of the heights of water and other information needed to make an approximate estimate of the amount flowing in the rivers at to places are taken by water-works and mill the rivers at 19 places, are taken by water-works and mill superintendents, or special observers, and are forwarded

superintendents, or special observers, and are forwarded monthly to this office.

Schedules are prepared each month to show the day on which each sample of water should be collected, and are so arranged that the samples will reach the laboratory at a nearly uniform rate during the first five week days of each week, in order to permit them to be analyzed promptly when received. The schedules are also arranged so that waters having some relation to each other shall be collected on the same day or in the case of rivers, after such lected on the same day or, in the case of rivers, after such an interval of time as will allow the water to flow from one

sampling place to another.

The willing co-operation of the water-works superintendents and others, and their readiness to collect and forward samples of water and to take such observations as we have desired, have added greatly to the value of the

work done.

In arranging in the beginning where samples of water should be taken it was the aim to get them in such a way that the chemical analyses would not only furnish a standard for future comparisons, but that they should show in addition general laws affecting the purity of water-supplies. With this in view samples were taken of groundwaters from filter-galleries, wells, and basins, and of surface-waters in neighboring ponds or streams, to determine face-waters in neighboring ponds or streams, to determine the effect of such filtration as might take place; other samples were taken to show the effect of storing ground or surface waters in open distributing-reservoirs or in open or closed water-towers; others the effect of continuous filtration through a thin layer of sand or gravel; others the comparative quality of water taken from the surface, mid-depth, and bottom of deep reservoir; others a comparison between water entering a storage-reservoir and after standing in it, and others the effect of aeration caused by the flow down a long steep brook of water previously storad in a reservoir. viously stored in a reservoir.

Many results have already accumulated, and an examination of them indicates that in addition to the great fund of scientific knowledge which they will furnish, much of the practical value to those designing and superintending water-works may be learned from such comprehensive

When the first filter-galleries were built beside the rivers when the first liter-galleties were built beside the five-or ponds it was expected to get water filtered from the neighboring surface-supply. It was found, however, that the water from the galleries differed very much in chemi-cal analysis, temperature, and appearance from the sur-

face-waters, and before pumping stood at a higher level. From this it was concluded that the water did not come from the neighboring pond or stream, but from the land

There are, however, several reasons why it seems prob-There are, however, several reasons why it seems probable that water drawn from filter-galleries, or by other means from the ground in the vicinity of bodies of surface water, comes to a large extent from the latter source; and it was thought that if this could be shown to be the case, and it could be shown at the same time that the filtered water lost the general characteristics of surface waters and assumed those of ground-water derived from rainfall soaking into the ground, the knowledge would be of much practical value to those locating or enlarging a ground-water supply. water supply.

To settle the question, if possible, a special case was

chosen for thorough investigation where the supply for a town was pumped from a filter-gallery, distant about 130

town was pumped from a metaganicity, distant about 156 feet from the shore of a pond.

The amount of water pumped from this gallery during the year equals a daily average of about 900,000 gallons. The pumps are operated during each week day for about

ten hours, no pumping being done on Sunday.

The level of the water in the filter-gallery remains permanently below the surface of the pond, lowering when the pumps are in operation and rising when they are stopped. In the evening it was about four feet below the pond.

This particular source of water-supply was chosen in preference to any other because the pond was artificially salted by the drainage from manufacturing establishments on its feeders; so much so that it contained about ten times as much chlorine (one of the components of common salt) as most ponds at the same distance from the sea and not affected by drainage.

The value of an abnormal amount of salt in a surface

The value of an abnormal amount of sait in a surface water for determining the source from which water comes to a filter-gallery lies in the fact that it is a stable chemical compound, and is not removed when the water containing it in solution is filtered through the ground.

It in solution is hitered through the ground.

The water of the filter-gallery contains 2.4 parts of chlorine per 100,000, or about six times as much as is usually found in water at this distance from the sea. This large quantity may be accounted for in two ways: either by the filtration of water from the pond, or by some abnormal condition of the soil which makes the water from by the filtration of water from the pond, or by some abnormal condition of the soil which makes the water from the land side rich in chlorides. To determine whether or not the water from the land side presented this unusual feature, samples of water were collected from an unpolluted brook and pond in the vicinity, and from several pits dug deep enough to collect water coming to the filter-gallery from the land side. In the samples of the water from the pond, brook and three of the pits in which the water stood pond, brook, and three of the pits in which the water stood at a higher level than in the pond, the amount of chlorine varied from 0.25 to 0.45 in 100,000, averaging 0.37, or less than one-sixth of the amount in the filter-gallery. Just what the figures that have been given mean may be more easily understood by showing the results in a different form.

The average amount of water pumped daily from the filter gallery may be stated in round numbers as 900,000

gallons or 7,500,000 pounds.

The chlorine in the water is found to be 2.4 parts per 100,000, equivalent to 180 pounds of chlorine in the daily

pumpage.

If it is assumed, as is probably the case, that all the chlorine in the water is combined with sodium in the form chlorine in the water is combined with socium in the form of common salt, it can be shown from the relation which these two components always bear to each other that the total amount of salt pumped per day is 297 pounds. An equivalent amount of water derived from the land side would contain only 46 pounds of salt, while the same amount of water derived wholly from the pond would contain the pounds.

amount of water derived whorly from the point at the filter-tain 462 pounds.

These figures not only show that the water in the filter-gallery is a mixture of the waters from the pond and land side, but they permit a fairly good estimate to be made of the proportion which must come from each source to produce the degree of saltiness equivalent to that found in the water from the gallery.

Such an estimate shows sixty per cent. of the water to

Such an estimate shows sixty per cent. of the water to have come from the pond and forty per cent. from the land side, during the seven months under consideration.

Before leaving the subject of the source of this water-supply it may be well to state that it is improbable that much of the water derived from this pond comes through much of the water derived from this pond comes through the comparatively narrow strip of ground separating the pond from the gallery; in fact, the statement may be made in a general way that in the bed of a stream or pond the spaces between the grains of sand and gravel usually become choked up with silt and vegetable matter to such

become choked up with silt and vegetable matter to such an extent that little water will pass through any given square foot of surface; and it is only where a large area of bed overlies or adjoins the porous stratum that it is safe to expect that a large supply can be obtained by filtration. When the water is once in a coarse gravel stratum of considerable extent it may find its way readily to a filtergallery, even from a long distance. That some of the water came from a long distance to the gallery in the case specially investigated was proved by test pits dug near the shore across an arm of the pond and 1,000 feet from the pallery. gallery.

Where water from the land side is mentioned in this report, it refers only to water derived from rainfall soaking directly into the ground, and not to that which frequently enters a filter-gallery or well from the land side, having come by a circuitous course from the



^{*}Abstract of the report of Mr. F. P. Stearns, Chief Engineer of the State Board of Health of Massachusetts, for the year 1887, from report of State Board on Water-Supply and Sewerage, being Senate Document No. 4.

The water surface in these pits stood several inches below that in the pond, fluctuated with the change of level in the gallery, and the water from them contained more normal amount of chlorine found in the groundwater in this vicinity, showing that some of pond-water passed through these pits on its way to the gallery.

Coarse gravel will hold in its interstices about thirty per

cent. of its volume of water, and where the gravel beds are extensive the large body of water contained in them has to move slowly toward the filter-gallery to furnish the amount pumped, so that some of the water may be weeks or even months in its passage through the ground.

Upon examining the analyses of water from the pond and filter-gallery the difference between the two cannot in most features be accounted for by the mixture of water from the pond and land side in the proportion before stated. Sediment, turbidity, color and odor which are very noticeable in the pond-water, are absent in the water from the filter-gallery. The residues and chlorine do not show a greater difference than can be accounted for by the mix-

The change in the ammonias is the most noticeable feature, the gallery-water containing but one eleventh as much free ammonia and one seventeenth as much albuminoid ammonia as that from the pond. The greater amount of nitrogen as nitrates and nitrites (nearly all n'trates) in the gallery-water might be accounted for by the m xture of the waters, but it is more probable that the increase is due to the oxidation and consequent purification of the decomposing nitrogenous matters indicated in the pondwater by the presence of the ammonias.

The water of the pond is shown by the analyses to be entirely unfit for drinking, while water from the gallery analyses well in many respects, but is to be viewed with some suspicion on account of its source.

In addition to the chemical analyses of these waters. other examinations were made to determine whether bac-teria and the grosser forms of microscopic life (algæ, etc.) found in the pond-water were removed by its filtration through the ground to the gallery. The mean of these results shows that the gallery-water contains but one-tenth as many as that from the pond. In many other instances in this State, where comparisons have been made of the number of bacteria in surface waters and in the filter-gal-leries or wells beside them, much greater differences have been found than in the cases above given; an extreme instance showing a ratio 16,500 to 2.

The bacteria found in all of these cases may have been and probably were harmless, but since the best known of the pathogenic bacteria are no smaller, it seems fair to assume that the means which will remove one will remove

That filtration through even a moderately thin layer will under proper conditions, remove a very large percentage of the bacteria from water, has been very definitely shown by the experiments of Dr. Percy F. Frankland by practical experience in the filtration of the water-supplies of London and Berlin, and by recent experiments at the Lawrence Experimental Station, described in the report of the board which this accompanies. In fact, the efficiency of the Berlin filter-beds is now determined by the percentage of the bacteria which they will remove from the water.

The examination of the waters of the pond under consideration for microscopic growths other than bacteria, showed the presence in abundance of several species of algæ, some of which were gelatinous forms which readily algæ, some of which were gelatinous forms which readily decompose and produce disagreeable tastes and odors in the waters; other growths were present in small numbers. The water of the filter-gallery did not contain any of the species of organisms found in the pond, though it did contain a few other species—one in some abundance.

These results are in accordance with those obtained from other water-supplies somewhat similarly situated.

In the warmest weather in summer the tempera ure of the water of the pond was as high as 80° Fah., while that of the filter-gallery was about 52°.

As a general result of this and other special examinations.

As a general result of this and other special examinations, corroborated in many respects by similar results found at other water-supplies in the State, the following practical conclusions may be drawn:

That it is practicable in many instances to obtain a sup-ply of water from a bed of porous gravel adjoining an un-failing pond or stream, without reference to the amount of

tter that may be obtained from the land side. That where the soil does not contain soluble matters to injuriously affect the water, it will, when so obtained, be much purer by chemical and biological standards, will be much cooler in summer, and in all sanitary and commercial features will be much better than water taken directly from the pond or stream.

That since it is impracticable in many cases to get an entirely satisfactory supply of water, it is preferable to obtain a ground-water supply by filtration from a surface source that is somewhat objectionable, rather than take surface-water directly from a source that is some degrees

less objection ble.

There are other conclusions which ought not to be drawn to which it is equally well to call attention

It should not be inferred that the results above indicated will be obtained where only a thin layer of sand or gravel intervenes between the surface source and the filter-gallery, and the filtration is continuous, since examinations, in several instances, of water filtered under such circum-stances have shown it to be worse than that which had not been filtered; nor should it be inferred that it is safe to take a supply by filtration from a seriously polluted body of surface-water, since, while the chemical analyses show by far the larger portion of the decomposable organic mat-

ter indicated by the ammonias to have been removed by filtration, yet the small amount remaining may be of a harmful nature, and there is no definite assurance that the purifying powers of the soil may not at times be overtaxed.

It may properly be urged as an objection to seeking a supply of ground-water that the quantity to be obtained cannot be told with the same certainty as that from a visi-ble supply. The quality of the water, however, makes it desirable to secure such a source when practicable; and while the exact amount of water cannot be ascertained in advance of the actual construction and test of the well or filter-gallery, a competent engineer, experienced in these matters, can form a judgment upon which much reliance may be placed.

In addition to the analyses of the waters of the pond and

the filter-gallery, already discussed, the water in the open distributing reservoir has also been analyzed.

When the pumps are in operation, the surplus water goes to this reservoir, and nights and Sundays when the pumps are stopped it surnishes the water used. Complaint is made in summer by those using the water that it tastes badly when it comes directly from the reservoir, while that coming directly from the filter-gallery does not.

The chemical analyses show that in nearly all other respects the water has seriously deteriorated in quality by

storage. Sediment, turbidity and odor make their appearance in the reservoir water. Free and albuminoid ammonia, indicating the presence of decomposing or decomposable nitrogenous organic matter, have greatly increased, while the nitrogen in the form of nitrates has decreased, apparthe passage of a portion of the nitrogen from the inorganic to the organic condition.

A cause for this and a practical remedy appear to have been found by Mr. G. H. Parker, the biologist of the board, charged with the examination of water for organisms other than bacteria, and are contained in his accompanving report.

The remedy which he proposes (the entire exclusion of light to stop the growth of vegetation) has been applied in the case of the iron storage tank of the Brookline high service, and the serious trouble from bad taste, which previously existed, has entirely ceased; moreover, the chemical purity of the water in the tank is as great as at the

The marked deterioration, as determined be chemical analyses, of ground-water stored in large open reservoirs, is a feature in all cases that have been examined. The amount of deterioration is somewhat variable.

In a majority of cases water from such reservoirs has, at times, tasted badly. In but few cases has trouble of this kind been reported from water stored in iron tanks; but these few cases, and particularly the one already mentioned, make it desirable to exclude the light from any to be built in the future, or from any that give trouble at the present time. Where water from a pond or other surface source is pumped and stored in an open distributing reservoir no marked change in the analysis takes place.

CEMENT MORTARS FOR USE IN PUBLIC WORK.*

No. III.

(Continued from page 266.) SAND IN MORTARS.

WITH reference to the quality of the sand used for admixing with hydraulic cement to make mortar, all of the authorities upon the subject agree that the same should be authorities upon the subject agree that the same should be coarse, sharp, clean, and free from vegetable, earthy, loamy, or clayey matters. If suitable clean sand is not available, the impurities contained therein should be removed by thorough and repeated washing.

Vicat, in the course of elaborate experiments with limes and mortars in the early part of this century, established standards for size of grain of what he termed coarse sand and fine sand as follows: coarse sand being such as will pass through a sieve of 64 meshes per square inch and be pass through a sieve of 64 meshes per square inch and be retained on one of 289 meshes per square inch; while fine sand will pass through a seive of 289 meshes per square inch, and be retained on one of 625 meshes per square inch. On this definition he ranked the superiority of coarse, mixed, and fine sands with limes according to the following schedule

For eminently hydraulic limes, 1. fine; 2. mixed; 3. coarse.

For slightly hydraulic limes, 1. mixed; 2. fine; 3.

For fat or quick limes, 1. coarse; 2. mixed; 3. fine. It will suffice to say that with cement mortars much better results are obtained when the sand is of the size of

grain above described and is sharp and clean.

Mr. Clarke says that when the sand was formed of a mixture of fine and coarse grains nearly as good results

mixture of fine and coarse grains nearly as good results were attained as with coarse grains alone.

Before leaving this subject it may be of interest to refer briefly to the experiments made at Wilhelmshaven in 1877 by H. Arnold, C. E., as published in the Journal of the Hanoverian Architects' and Engineers' Society for 1883, and from which it was found that the size of gaain and quality of the sand used in Portland cement mortar are important factors in its ultimate strength.
With six different kinds of substantially clean sands and the same brand of cement mixed into mortar in the pro-portions of three volumes of sand to one volume of

*Ab-tract of a report by the Executive Board of the City of Rochester, N. Y., prepared by Emil Kuiching, M. Am. Soc. C. E.

cement, the tensile strength after seven days ranged from 101 to 243 pounds per square inch, and after two

101 to 243 pounds per square inch, and after twenty-eight days from 133 to 311 pounds per square inch, thus exhibiting extremely wide variations, depending largely upon the size and roughness of the grains of sand.

In every instance it was found that a greater strength was developed with a coarse-grained sand free from very fine particles and dust, than with a fine-grained sand, both being equally sharp. Mr. Arnold also points to the fact deduced from his experiments, that with the same cement but different sands of similar size of grain, the cohesion of the mortar may be found to vary considerably, and well of the mortar may be found to vary considerably, and with probably depend upon the chemical composition of the sand. He, therefore, concludes that in order to obtain satisfactory results from the cement mortar used in the construction of public works, the quality of the said available in the particular locality should first be taken into careful consideration.

If no other than a fine sand happens to be available and a given strength of the mortar is to be attained at the end of one week, experiments should be made to learn whether the proportions of sand to cement named in the specifications should be changed, since the strength diminishes rapidly with the quantity of sand used; and in such an event it may also be advisable to use an entirely different kind of cement. It is a necessary condition of success in mortamaking that every particle of the sand or "aggregate" be completely covered with the cement or "matrix"; and since, when the grains in a given volume are small, the magnitude of the total surface to be covered is greater than when the grains are large, it follows that fine sand requires a larger proportion of cement than coarse sand. Any specification or plan contemplating the use of a good coarse sand must, therefore, be altered if fine sand alone is used, or else the quality of the work will be impaired.

In support of the foregoing remarks, it has been quite generally observed by engineers that when most of our American natural cements are mixed entirely with fine sand, the process of hardening is greatly retarded, even if not entirely prevented, while the same cements, when tested not entirely prevented, while the same cements, when tested neat, exhibit a cohesive strength ranging from 50 to 136 pounds in twenty-four hours, thus showing conclusively the effect of admixing the fine material. An instructive pounds in twenty-four hours, thus showing conclusively the effect of admixing the fine material. An instructive instance of this kind was noticed in this city about a year ago, where an excellent quality of Akron "Star" cement was mixed with very fine sand from the Pinnacle pits in the proportion of 2½ sand to 1 cement. For several days the mass remained in a plastic state in the tin can in which it had been deposited, and upon being removed and exposed to the air upon a window sill for several mostly. exposed to the air upon a window sill for several months, it displayed very little strength and broke in handling. On the approach of cold weather, the largest fragment was kept in an apartment constantly heated by steam, and alter lying undisturbed therein for three months, pieces could asily be broken off with the fingers. At the present time, after having attained an age of one year, it is still quite friable and entirely unfit for use. Another mass of mortar prepared at the same time from the same cement, but with clean, coarse sand, mixed in the proportion of 3 sand to 1 cement, indurated promptly and exhibited far better qualities. qualities.

IMPURITIES IN SAND.

In order to determine what amount of lime, loam, or clay might be added to the sand of a cement mortar for the purpose of making the same more plastic, and at the same time without seriously affecting its strength, Mr. Charles Colson, C. E., made a large number of excellent experiments, which were submitted in 1878 to the Institu-tion of Civil Engineers, London. As a result he found that the addition of lime and loam reduces the initial strength of the mortar considerably, the reduction due to the addition of loam being more marked than by the addition of lime. A quantity of either of these substances amounting to one-twelfth of the volume of the sand was amounting to one-twelfth of the volume of the sand was found to be as large as could be admitted in the mixture with Portland cement to give, after six months, a cohesive strength equal to that of English gray-lime mortar of the same age. Thus, with three different samples of gray lime, mixed in the proportion of two sand to one lime, the tensile strength of the mortar after six months ranged from twenty-seven to forty-seven pounds per square inch; with Portland cement mixed eight sand to one cement, the arti-Portland cement mixed eight sand to one cement, the average strength was sixty-nine pounds per square inch: and by adding to this latter mortar an amount of quickline or loam equal to one-twelfth of the volume of sand the or loam equal to one-twelfth of the volume of sand, the strength was reduced to fifty-nine pounds and thirty-eight pounds per square inch, respectively. It will accordingly be seen that even after so long a period as six months, the addition of so small a proportion of loam reduces the tenacity of the mortar nearly one-half. It should also be remarked that the principal object of Mr. Colson's tests was to ascertain what proportion of Portland cement and would produce a mortar equal in strength to and as convenient to work as oray-line mortar mixed in the noconvenient to work as gray-lime mortar mixed in the proportions usually adopted for building purposes.

Another interesting series of experiments with Porland cement mortar, in which the sand used contained more or less peaty matter or vegetable mold, has quite recently been published by Mr. O. Lieven, Superintendent of a certain cement factory in Russia. The sand here contained 4.3 per cent. of humas and the moster made with it failed 4.3 per cent. of humus, and the mortar made with it failed to harden appreciably, even after a month's exposure in either air or water. Like results were obtained when the same sand was mixed into mortar with other brands of Portland coment. To show that shows a more were not Portland cement. To show that these cements were not at fault, they were mixed with clear standard sand, from any admixture of vegetable mold, in the usual proportions of three sand to one cement, and the mortans



acquired a tensile strength of 178 pounds per square inch after twenty-eight days. Mr. Lieven is of the opinion that the humic acid contained in the peat or vegetable mold unites with the free lime or lime compounds in the cement to form a kind of soap which envelops the smallest particles of the mortar and prevents the same from adhering together.

COMPOSITION OF MORTARS.

Debauve, in his large and excellent work entitled "Manuel de l'Ingenieur des Ponts et Chaussées," Fasicule 4. page 198, gives the following table showing the compo-sition of various mortars according to the best French authorities cited by him:

	Pa	ts by	Parts by measure of	of.	
KIND OF MORTAR.	Lime.	Puzzolana.	Cement.	Sand.	Remarks.
Common lime morter	3			2 8	Sand to be sharp and coarse
Same for outside walls	1.00			2.57	Sand to be sharp and coarse.
Lime and Puzzolana	1.00		:	3.76	Mortar slightly hydraulic.
Lime and Puzzolana	 8			2.78	Mortar strongly hydraulic.
Ordinary water lime	8	•	•	3. 8	• •
Strong water ime	_	1.00	:	2.50	Used in sewers of Paris.
Hydraulic lime for rendering					
or coating		1.00	:	2.27	Lime slaked by immersion.
Hydraulic lime of Theil	1.0	:	:	2.08	Harbor works of Marseilles, Toulon, etc.
Natural or " Koman " cement.	-	:	3 8	:	Neat for stopping springs or leaks.
Natural cement mortar				3. O	For rubble masonry, copings, etc.
Natural cement mortar	:	-	I.00	3.8	For walls not immediately loaded.
Portland coment mortar	:	:	: 8	2.40	For sea-wails, etc., face work.
Portland coment mortar	:	:	.8	3.69	For sea-walls, etc., backing and filling.
Portland cement mortar	:	:	<u>.</u>	ي. ن	For sea-walls, etc., coating or rendering
Portland cement mortar	:	:	٠ <u>.</u>	2.40	For arch masonry on land.
	:	:	1.00	3.œ	For backing or filling.

O ccasionally, for particular work, equal parts of cement ccasionally, for particular work, equal parts of cement and sand are specified, as for pointing mortar; but, as a rule it will be found that engineers at the present time require cement mortars for sewer, retaining wall and brid. ge masonry to be mixed in the proportions of one part of cement to not more than two parts of sand; and it is only when some particular brand of Portland cement has been satisfactorily proven to be capable of developing the requires is the appropriate are varied in such works. above proportions are varied in such works.

EFFECT OF FROST UPON MORTARS.

is a matter of common knowledge that ordinary quicklime mortar which is exposed to the action of frost before it has become well set or indurated will thereby become greatly injured in its adhesive and cohesive properties; and hence it is customary to suspend all building operations where such mortar is used on the arrival of the operations where such mortar is used on the arrival of the cold season. Should, however, it be necessary to proceed with the construction, experienced masons and builders sometimes make use of a quick-setting cement mortar in place of lime, and cease work when the weather is at all severe. It is, therefore, also of importance in private work to learn something of the behavior of cements under such a circumstances.

work to learn something of the behavior of cements under such circumstances.

The impression seems to prevail quite extensively that cement mortars are not appreciably injured by freezing, and that masonry may safely be constructed at any temperature below the freezing point, at which a man can still work, provided that either brine be used instead of fresh water, or that the materials be first heated. With regard to the use of brine or salt, it may be remarked that when the mortar will be injured thereby or not seems to depend principally upon the character of the cement. Most pend principally upon the character of the cement. To the natural or "Roman" cements suffer a considerable loss of strength if mixed with salt water, while the land cements do not appear to be materially affected.

Respecting the practice of heating the cement, sand water before mixing, and then using the hot mortar in old weather upon frosty stones or bricks, or depositing it in icy water, the experiments of William W. Mac ay. C. E., submitted in 1877 to the American Society of Civil Engineers, show indisputably that such a met of injury is effected when heated mortar, even if met od of treatment is entirely erroneous, and that a great amo nt of injury is effected when heated mortar, even if mad of Portland cement, is immersed directly in cold water. The tests were all made with Burham Portland cement which, when tested neat at ordinary temperature, a tensile strength of 278 pounds per square inch after several days. In one series of experiments, the ingredients of its mortar all had a temperature of about 40° Fah, and another they were heated to 100° Fah. These two sets briquettes were kept for seven days in precisely the manner, and were broken on the same day, so that hanges in temperature during this period would necessarily affect them alike. The averages of the tensile strengths acquired show that by first heating the ingredients to about 100°, then mixing them in air having a temperature of from 13' to 37°, and then upon exposing the briquettes for six days to the winter weather, their strength in the case of neat cement was only from 7 to 20 per cent. of that attained when the materials were mixed without heating, or with the temperature of the mortar at 40°; and in the case of mortar mixed in the proportion of 2 sand to 1 cement, the tensile strength of the heated mortar after 28 days was only 30 per cent. of that reached by the cold mortar at 40°. From these and other similar experiments Mr. Maclay concludes that the mixing of cement mortar with highly heated materials, for use above water in very low temperatures, greatly reduces its normal strength, and that for use below icy water its value will thereby be almost entirely destroyed. If mortar must be essarily affect them alike. The averages of the tensile thereby be almost entirely destroyed. If mortar must be used at all in such weather it should be used cold, and the used at all in such weather it should be used cold, and the only condition to be observed is that the materials shall be free from frost at the time of using. "In the experiments where the materials were mixed cold and then exposed to the winter weather, Portland cement mortar appeared to set without freezing, even in as low temperature as 13° Fah., except when it was windy; but where the briquettes were made of hot mortar they invariably froze as was proven by their becoming soft again when froze, as was proven by their becoming soft again when the temperature rose."

Portland cement was found to possess the peculiarity, also noticed by many other writers on the subject, of setting in a low temperature, wherein other varieties of cement will surely freeze. No definite limits of this action, however, have yet been assigned. Mr. E. Leblanc exposed cakes of Portland cement mortar to frost immediates. ately after mixing, and before any setting had occurred, with the result that "they cracked deeply, and in part

incurred by such freezing ranging after seven days from 2 to 22 per cent. in the case of neat cement, and from 3 to 24 per cent. in the case of the mortar mixed as above 24 per cent. in the case of the mortar mixed as above described; also ranging after twenty-eight days from 2 to 12 per cent. in the case of neat cement, and from 1 to 33 per cent. in the case of the mortar. It should be noted particularly that the foregoing results were derived when, pure, clean, and standard materials only were used. On the other hand, where the cement was adulterated with 30 per cent. of pulverized slag from a blast furnace the loss in strength by freezing was much greater than above given, especially in the case of the mortar. After seven days, this loss ranged from 6 to 62 per. cent., and after twenty-eight days from 21 to 44 per cent., standard sand having been used.

Other interesting experiments with regard to the effect of frost on Portland cement mortar were carried out early in 1886 at Hamburg, Germany, by Mr. M. Moeller, C. E., and an account thereof is contained in the "Deutsche Bauzeitung" for November 17, 1886.

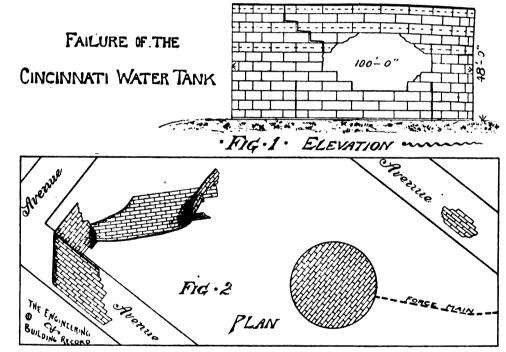
(To be continued.)

(TO BE CONTINUED.)

THE BURSTING OF A WATER-TANK IN CIN-CINNATI IN 1881.

THE epidemic of water-tank disasters which visited this country last fall has happily ceased, but its recollection is still sufficiently fresh to lend interest to the following account of a similar occurrence in Cincinnati nearly seven years ago, taken from the report of Mr. A. G. Moore, Superintendent and Engineer of the Water-Works of that

The tank, which was designed by Mr. Moore's prede



became disintegrated, but the detached fragments after being thawed were found perfectly hard." In Mr. Mac-lay's experiments none of the Portland cement briquettes lay's experiments none of the Portland cement briquettes when mixed cold cracked in the slightest degree, even when exposed to as low a temperature as 11° Fah., and they all became hard after thawing. This seems to be the prevailing opinion among engineers. Mr. J. Dutton Steele, C. E., in discussing the paper of Mr. Maclay, states that "cement mortar is not seriously impaired by being laid in frost, as its property of setting is simply held in suspense during the time it remains frozen." Gen. Q. A. Gillmore, U. S. A., in his work on "Beton," etc., remarks that "when the temperature is not much below the freezing point during the day work may be safely carried on, if care be taken to cover over the new material at night. After it has once set, and has had material at night. After it has once set, and has had a few hours to harden, neither severe frost nor alter-

a few hours to harden, neither severe frost nor alternate freezing and thawing has any effect upon it."

In the report of the work performed at the Royal Testing Laboratory of Berlin for 1886, there is an account of a number of experiments for ascertaining the effect of frost upon the strength of Portland cement, both neat and when mixed into mortar in the proportion of 3 parts of sand to I of cement. These tests were made in two distinct series, the first one involving only a single exposure to frost on and during the sixth day after mixing, while in the second series the briquettes were treated as follows: first, allowed to indurate for twenty-four hours in the air of a warm room: second. exposed for twenty-

follows: first, allowed to indurate for twenty-four hours in the air of a warm room; second, exposed for twenty-four hours to a freezing temperature of from +10° to +5° Fah.; third, thawed four hours in a warm room; fourth, placed under water until tested.

The experiments were made with six different brands of cement, and for each set of briquettes exposed to frost another similarly constituted set was kept in temperatures above the freezing point to serve as a basis of comparison of tensile strength. Upon testing the frozen and unfrozen samples, it was found that the effect of frost varied greatly with the quality of the cement, the loss in tensile strength

cessor, was of Bessemer steel, 100 feet in diameter and 48 feet high, and, when filled to its intended depth of 46 feet. held about 2,700,000 gallons.

The cylinder was composed of 12 courses of plates, 12 feet long and 4 feet high, varying in thickness from the bottom up as follows: $\frac{5}{8}$, $\frac{7}{16}$, $\frac{7}{2}$, $\frac{7}{16}$, $\frac{3}{8}$, $\frac{5}{36}$, $\frac{5}{16}$, $\frac{5}{16}$, $\frac{7}{16}$, and the upper courses were stiffened by internal angles and channels, presumably where indicated by dotted lines on Fig. 1. All the horizontal joints were lapped and single riveted, the vertical joints in the six lower courses were butted, strapped and double riveted and in the six upper ones were lapped and double riveted. The floor was also of 4x12 plates, all 3/6inch thick, with lapped and single-riveted joints. A ring of angle iron 4"x6"x¾" connected the sides and floor by one and two rows respectively of 15-inch rivets. The foundation seems to have been sufficient and was covered by a layer of sand on which the tank was supposed to have acquired a uniform bearing.

The contract provided that specimens from each plate should show a tensile strength of at least 65,000 pounds per square inch. This appears to have been fully complied with; the strength as recorded varying from 71,000 to 90,000 pounds.

Specimens tested from the broken plates after the accident showed a strength of from 70,120 to 75,200 pounds; an elastic limit of from 39,727 to 44,300 pounds, and a reduction of from 31.4 to 46.5 per cent.

The tank was completed in the fall of 1880 and remained empty until the 17th of June following when water was let in, and, twelve days later, when the water had reached a depth of 391/2 feet, a rupture occurred at the top edge of the third course, at a distance of 12 feet from the bottom of the tank, and immediately at the junction of the abutting plates of the fourth course. It extended through the solid plates and through the riveting, both vertically and horizontally; a section 24 feet in height by 48 feet in length being carried some 100 feet distant.

From the initial rupture the fracture descended vertically through the solid plate of the third, the vertical joint of the second, and the solid plate of the first course to its connection with the bottom, and from the top edge of the dislodged section it ascended obliquely through riveting and solid plates to the top. The entire remaining cylinder was torn from the bottom and deposited at a distance of about 150 feet from the foundation. The bottom remained in position, receiving only slight distortions.

In separating from the bottom the 5%-inch plate of the cylinder tore through the single line of rivets connecting it with the angle-iron ring before mentioned.

Figure 1 shows the location of the rupture, and Fig. 2 the location of the fragments after rupture.

The foregoing data will show that with the amount of water in at the time of rupture the factors of safety in the cylinder were as follows: at its lower edge about 3, and at the upper edge of the third course, where rupture began, about 41/2. The workmanship seems to have been good, and, although the margin of safety with a full tank was small, being only a little over 21/2, there does not seem to be anything in the structure of the tank to explain its failure, and we are inclined to agree with Mr. Moore, who says, that, in his judgment, the material, although possessing high tensile and fair ductile properties, could not withstand the aggravation of the excessive and continuous distortions which were caused by the prevalent high winds during its construction, which extended through many months, and adds: "At the period of my accession to this office the structure was advanced to thirty-two feet in height, and it was so readily disturbed by the wind that the workmen were at times compelled, for safety, to desert the scaffolding. Action was at once taken to stiffen the succeeding courses, but my impression is, that the integrity of the preceding work must have been reduced, as the immense diameter of the tank favored excessive vibration.

Our readers will remember that a similar cause was suggested by Mr. John F. Ward as a possible reason for the fall of the Seneca Falls stand-pipe. The lesson for tank and stand-pipe builders is too obvious to need further comment.

THE REMOVAL OF THE WELLS STREET BRIDGE, CHICAGO.

THE old bridge crossing the Chicago River at Wells Street was an iron structure built by Fox & Howard shortly after the fire. It was a draw-bridge 185 feet over all, with trusses spaced 19 feet 3 inches apart between centres, and two sidewalks outside of the trusses. The width of this bridge being inadequate for the traffic over it, contracts were let by the city for the building of a new bridge 60 feet wide.

The usual procedure in cases of this kind is to sell the iron in the old superstructure for scrap. In this case an agreement was made between the city and the North Chicago Street Railroad Company, whereby the latter company, in exchange for certain privileges granted, was to build piers and abutments at Dearborn Street, and to remove the old superstructure of the Wells Street bridge to Dearborn Street, the new masonry to be built of proper dimensions for this purpose. Dearborn Street is three squares east of Wells Street.

It was found that any other plan than moving the superstructure bodily was impracticable, because of its peculiar

construction. The top chord consists of four channel bars with top plate. These parts break joint in such manner that, in order to separate the chord into sections, it would have been necessary to cut out practically all the rivets. Suspension bars, lateral rods, etc., are adjustable members, and it is doubtful if the nuts for these could have been taken off without damage.

The plan of moving was as follows: Four scows, about 20 feet wide by 40 feet long each, were hired and were fitted with trestles on their decks as shown in the illustration. Two of these scows were placed under the middle of each arm of the bridge. The trestles were built to such a height that they would just clear the bottom of the bridge after sinking the scows nearly to the level of the water. The scows were sunk by boring holes in their bottoms and allowing the water to nearly fill them, after which the holes were plugged. After the scows with their trestles were placed in position under the bridge the water was pumped out and sufficient power was thereby obtained to lift the superstructure off of its supports. The drum was left attached to the trusses and transported with them. The scows, with the superstructure on top of them, were then floated down the stream with the current, the bridge, however, being first brought parallel to the stream by holding one end and allowing the other end to swing around with the current. The bridge was floated in this position through Clark Street bridge, which was swung open for the purpose. At Dearborn Street the bridge was turned around at right angles to the stream, and after placing it over the new centre pier the scows were again filled with water and removed with their trestles from under the bridge.

The work was done safely and quickly. Owing to ice and rain in the morning, operations were not begun until early in the afternoon of March 26. The rain had then ceased, but a strong west wind was blowing, which caused the current in the river to set towards the lake and lowered the surface of the water about six inches while the pumping was going on. Two tugs had been engaged, which assisted the men in the pumping. It took about three hours to empty the scows of their water.

As the bridge was lifted off the centre pier it was easy to see if there was any swaying. None, however, was perceptible except occasional slight oscillations. structure in floating down the river was very steady. In order to keep clear of the piers and pile-work at Clark Street the men, to the number of twelve, would move to one edge of the scows, but no swaying of the superstructure was apparent even then. The scows also scraped against obstructions on one or two occasions, but this caused no indication of danger.

It had been the intention to tow the structure by hand. but as the tugs had been engaged for pumping purposes and were on hand, and it was found perfectly safe to have them take the structure in tow, this was done, one tug being attached to the forward end of the forward scows and the other being attached to the rear end of the rear scows.

The latches holding the bridge to the abutments at Wells Street were drawn at about 4:45 P. M., and the moving was completed at about 6:15 P. M., at which time the superstructure rested safely on the centre pier at Dearborn Street, which, being higher by about 18 inches than the centre pier at Wells Street, it was found to be more convenient to move the wheels and track of the centre at a later day. Meantime bars of 4\%-inch round iron were used on which to turn the bridge temporarily, so as to have it point up and down stream.

wood-work in the old bridge was in such poor condition that there was no object in preserving it, and it was removed before the scows were placed in position. The metal work carried by the scows weighed about 120 tons.

The bridge will be put in use at Dearborn Street as soon as the approaches are completed, but as the city has not appropriated money for these, considerable delay may be

We are indebted for the above account to Mr. C. L. Strobel, M. Am. Soc. C. E., who planned and personall; superintended the entire operation, having taken the contract for it on behalf of the Keystone Bridge Company, of which he is the consulting engineer.

THE MANUFACTURE OF IRON AND STEEL IN INDIA.

THE manufacture of iron and steel appears to have been known in India much earlier than in Europe.

The Kutub pillar near Delhi is a prominent memorial of old Indian blacksmiths' art, and it would rather embarrass our modern European ironmasters, notwithstanding all their advanced appliances, if they had to produce such a piece of art as the wrought-iron column of Kutub in the way as it was produced some 1,600 years ago by Indian blacksmiths with their primitive machinery.

This column has a total height of twenty-three feet six inches, with a diameter of 16½ inches at base and twelve inches below the capital, the latter being 3½ feet high. Below the surface it expands to a bulbous form of two feet four inches in diameter and rests on a gridiron of iron bars

fastened with lead into the stone pavement.

This pillar has evidently been formed by gradually welding small pieces of iron together, but notwithstanding this rather difficult process, it shows no trace of a weld seam and no sign of rust, although exposed to the atmos-

phere for more than 1,000 years.

From the inscription which this column bears, *Indian Engineering*, from which this account is taken, concludes

Wrought-iron cannons of extraordinary length have been made in Assam without doubt, in a similar skilled way and difficult manner as the Kutub pillar at Delhi.

First, however, in importance in the history of Indian iron and steel industry is the fact that cast steel was made in India long before the manufacture of this most important metal was commenced in Europe, and that the excel-lent quality of Indian cast steel ("Wootz") has not been

reached in Europe as yet.

It is also hardly known that the material for the Damas cus blades, so celebrated in the middle ages and up to the last century, was made at Nirmal, a now rather important village in Hyderabad, from where Persian traders imported the same to Asia Minor, in spite of the great expenses, hardships, and even dangers they had to overcome to acquire this costly material from such an out-of-the-way

country, and so very difficult of access at that time.

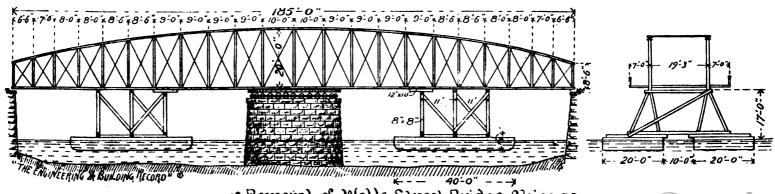
The methods employed by the natives of India for the production of iron and steel, of course, differ in their details with the different countries where they are practiced; they all correspond, however, in the following points:
(1.) All their methods are based on the use of vegetable fuel and no mineral suel is required. (2.) They all used compressed air for burning their suel. (3.) The methods are carried on on a small scale in each case. (4.) The quality of wrought iron or steel produced is in each case a most superior one. The following is a description of a native iron-works in Central India. The smelting-furnace is a shalt of clay, one foot square and three feet deep; this shaft is entirely filled with charcoal, and a charge of forty pounds of iron ore is heaped up over it; then the lighting and blowing commences. The bellows consist of two cylindrical leather bags which are pressed down alternately, whereby the compressed air is driven in a continuous stream into the oven through the funnels of clay, situous stream into the over through the tunnels of clay, situated about nine inches above the bottom of the furnace. After a couple of hours' blowing and several replenishings of charcoal, the smelting process is complete, when the master of the work draws from the bottom of the furnace. with a pair of tongs, an unshapely lump of iron, weighing from eighteen to twenty pounds; this is then dragged to the front of the building, when it is beaten with hammers till it is reduced to a disk of six to eight inches in diameter and two inches in thickness. As the natives add nothing to the ore in the furnace, the loss of metal through slagging is considerable. In this manner the work is continued ceaselessly for twenty-four hours, after which the furnace ceaselessly for twenty-four hours, after which the furnace requires repairing. During this time four laborers and one master are employed, the latter generally the owner of establishment.

The five men during the twenty-four hours turn out 165 pounds of half-finished iron.

The refining and finishing processes are carried on in rough open forges, and the articles manufactured are horse-

shoes, spades, clamps, and other small objects.

The same quantity of iron goods made with the present European appliances would consume but one-third of the fuel and one-half of the ore used by the native method.



~ Removal of Wells Street Bridge Chicago.



MAJOR-GENERAL Q. A. GILLMORE, U. S. A.

MAJOR-GENERAL QUINCY ADAMS GILLMORE, United States Army, died on the 7th inst. at his home in Brooklyn. He had been ill for about two weeks previous to his death with a complication of liver and kidney troubles, but for many years he suffered from malaria, contracted in the South during the war.

General Gillmore was born at Black River, Loraine County, Ohio, on February 28, 1825, his father being one of the earliest settlers of Ohio. He gained his early education in the country school, and later studied at the Norwalk (Ohio) Academy. For three years preceding his twentieth birthday he taught a district school and attended two terms at the high school in Elyria, Ohio.

He entered the academy at West Point in 1845, and graduated with high honors in 1849, standing first in his class of forty-three. He served as an assistant engineer in the building of Forts Monroe and Calhoun for the defence of Hampton Roads, and in 1852 he was made Assistant Instructor in Practical Military Engineering at the West Point Academy.

In 1856 he was promoted to a first lieutenancy, and was in charge of the fortifications in New York Harbor when the rebellion broke out. As Chief of Engineers he accompanied the Port Royal Expeditionary Corps, and took a prominent part in the operations upon Hilton Head, S. C.

General Gillmore took an active part in the seige of Fort Pulaski. He superintended the erection of the fortifications and commanded the troops in the engagement. The capture of the rebel stronghold in the Savannah River, through the superiority of his work and the skillful use of his artillery, at once established General Gillmore as a military man of rare merit, and he was rewarded by a promotion to Brevet Lieutenant-Colonel.

On March 30, 1863, he administered a crushing defeat to General Peagram in the battle of Somerset, for which he was brevetted Colonel, and later was given command of the Department of the South.

In July of the same year he was given command of the Tenth Army Corps, and directed the memorable operations against Charleston, S. C., which were characterized by marked skill and boldness, and resulted in his promotion as major-general of volunteers.

He was in command of the Tenth Army Corps at James River in 1864, and took an active part in the landing at Bermuda Hundred and the action at Swift's Creek. He was next engaged in the operations before Petersburg, and later commanded two divisions of the Nineteenth Army Corps in the defence of Washington.

During the pursuit of the rebels under General Early General Gillmore was severely injured by the falling of his horse, but was again in command of the Department of the South in 1865.

In December, 1865, he resigned his commission as major-general of volunteers, and returned to service in the Engineer Bureau at Washington, being subsequently appointed engineer-in-chief of all the fortifications and river and harbor improvements on the Atlantic coast south of New York. He was president of the Mississippi River Commission and of several boards for important river and harbor improvements, and as one of the judges at the Centennial Exposition in 1876 he made interesting reports on "Portland, Roman, and other Cements, and Artificial Stones," and on "Brick-making Machinery, Brick Kilns, Perforated and Enameled Bricks and Pavements." General Gillmore wrote a number of works on professional subjects that rank as authorities, among them being "Limes, Hydraulic Cements, and Mortars;" "Belton, Coignet, and other Artificial Stones;" "The Strength of the Building Stones of the United States," and "Roads, Streets and Pavements."

Oberlin College, O., conferred upon him the degree of Master of Arts, and Rutgers College that of Doctor of Philosophy.

General Gillmore was at one time president of the Kings County "L" road. He was married twice. Four sons by his first wife survive him.

He was buried at West Point.

STEEL VERSUS WROUGHT IRON FOR BUILDING PURPOSES.

THE following extract from a letter of Mr. C. L. Strobel, Mem. Am. Soc. C. E., not written for publication, will be found of interest:

"I have read the article 'Steel versus Wrought Iron for Building Purposes' in the issue of March 17, and you

are undoubtedly correct in the position you have taken are undoubtedly correct in the position you have taken. There is one element of economy, however, in favor of steel beams which was not mentioned. The lightest weight of 15-inch iron beams is 50 pounds per foot; whereas 15-inch steel beams are rolled weighing 41 pounds. The lightest weight of 12-inch iron beams is 42 pounds per foot; whereas 12-inch steel beams are furnished weighing 32 pounds, etc. If, therefore, a 12-inch 42-pound iron beam is required to carry a certain load, a 15-inch 41-pound steel beam can be substituted for it, giving not only much greater strength, but much less deflection as well.

""The rolling of these light sections in iron is difficult

"The rolling of these light sections in iron is difficult

"In connection, with the question of safety of metal constructions for buildings, I wish to call your attention to the general use of cast iron for columns. Formerly loads carried by columns were generally light, and the sections provided much in excess of the requirements. Of late, however, columns have assumed a much more important function in buildings. For high office buildings, warehouses, apartment houses, etc., the columns practically carry all the weight of the different floors in the building. The walls serve in many cases simply to fill in and form The walls serve in many cases simply to fill in and form an outer shell for the building. The factor of safety used is sometimes as low as 6. Practically no tests are made on cast iron as to quality. The columns are cast on their side, not on end as is usually called for in the case of water-pipe. The result is that in many cases the columns are very thin on one side and excessively thick on the other. Cast iron strutt taken out of old bridges show the other. Cast-iron struts taken out of old bridges show plainly how very unreliable castings are when made in this way. It is true that in buildings the loads are quiescent, but this does not improve matters much. A further consideration that should not be lost sight of is that the loads carried by the columns are almost invariably eccentric, so that cross strains are added to the direct compression. sive strains, thereby largely reducing the factor of safety.

ENGINEERS' CLUB OF ST. LOUIS.

THE two hundred and ninetieth meeting of the Engineers' Club of St. Louis was held at Washington University, April 4, 1888, President Holman in the chair, W. H. Bryan, Secretary, twenty-four members and four visitors present. The Executive Committee recommended Russell Parker for election to membership. He was balloted for and elected.

The report of the Special Committee on resolutions appropriate to the death of Frederick Shickle was adopted. Resolved, That, by the death of Frederick Shickle, the Engineers' Club of St. Louis has lost a most valuable member, one who has been with us from the beginning as a charter member, and whose zeal and life have been devoted to engineering pursuits-a man endeared to his fellow men by his kind and genial bearing and his ever courteous and upright conduct.

"Resolved, That we extend to his bereaved family our profound sympathy; and

"Resolved, That a copy of these resolutions be suitably prepared and presented to the family of our lamented

T. A. Meysenburg, William Wise, Committee.

The president presented a communication from L. E. Cooley, President of the Council of Engineering Societies on National Public Works, on the subject of "Reorganization of National Public Works." On motion it was made the special order for the next meeting, April 18.

The Secretary then read a paper on "Railroad Location; Field Practice in the West," by Willard Beahan. The author explained the difficulties to be overcome, and the most common methods employed. He also gave his own method, which he stated he had used largely, with very satisfactory results. The paper was discussed by Prof. Johnson and Messrs. Wheeler, Seddon, Moore, Bouton and Clark. There was considerable diversity of opinion as to the best method to follow.

Professor Nipher explained to the club a calorimeter he had prepared for the purpose of determining the heat value of fuels. The apparatus was shown and a test made. After some general discussion of Western fuels, the meeting adjourned.

FIFTH ANNUAL WATER REPORT OF MADI-SON, WISCONSIN.

THE report to the Water Commissioners of Madison, Wis., of their Superintendent, Mr. John B. Heim, contains, besides the usual local details, some matters of gen-

The population of Madison in 1885 was 12,063, and it is supplied with water under direct pressure pumped from seven artesian wells by two non-condensing Reynolds-Corliss engines combined with Knowles pumps of a joint capacity per twenty-four hours of 4,000,000 gallons. They pumped during the year 261,308,160 gallons, against

an average head of 224 feet, which gives 720 gallons per an average near of 224 feet, which gives 720 gailons per day to each of the 980 water-takers. This required 562 tons of anthracite coal, containing 86 per cent. of com-bustible, costing \$6.24 per ton, and burnt at the rate of 5.17 pounds per square foot of grate per hour. The cost 5.17 pounds per square foot of grate per hour. The cost of the coal required to raise 1,000,000 gallons one foot high was 5.98 cents, and the duty per 100 pounds of net combustible was 49.730,400 foot pounds. The revenue was \$13,470.69, and the operating expenses \$8,739.73, of which \$3,507.50 was for coal. The previous year Indiana block coal was used at a cost of \$2,747. The change was made in deference to the wishes of those who objected to the soot and smoke of soft coal.

The six reterior wells seemed to interfere with each

The six artesian wells seemed to interfere with each other, causing a deficiency in the supply, and the Shaw gang-well system used in Brooklyn, N. Y., was investigated, but found not suited for the location, so another six-inch well was bored and tubed 200 feet to rock, which gave a daily outflow of 115,000 gallons, and two more such wells have been contracted for. All persons have the privwells have been contracted for. All persons have the privilege of putting in meters at their own expense if dissatisfied with the water-rates. No kind of meter is specified, and only five are in use. The rates per 100 gallons are as follows: less than 300 gallons per day, 5 cents; 300 to 400, 4 cents; 400 to 1,000, 3½ cents; 1,000 to 5,000, 2½ cents; 5,000 and over, 2 cents. No rate to be less than

An interesting diagram is given showing the pumpage for each day, which varied from 455,400 gallons in April to 1,016,500 in August. There is also a map showing the location of all mains and hydrants with the normal pressure per square inch available at each of the latter.

Waste of water seems to be giving the usual amount of trouble. As soon as cold weather set in, in December, 1886, the consumption increased 25 per cent., with the result that during a night fire lasting less than three hours the pressure fell more than one-third at the pumping station, and when the regular consumption began in the morning suction was lost altogether, but, most fortunately.

by that time the fire was extinguished.

Careful inspection reduced the consumption from 25,000,000 gallons in December to 23,000,000 in January, and 17,000,000 in February, with no trouble from freezing of pipes. When inspection ceased the waste increased of pipes. When inspection ceased the waste increased again until 26,000,000 were used in August, which inspection again reduced to 21,000,000 in September. A lake connection is recommended to be used in case of fire, to be of 14-inch pipe carried out to 40 feet of water, at an

estimated expense of \$6,000 to \$8,000.

Six water-motors are in use and it has been decided not to permit the use of any more except for sewing machines, and it is recommended that sprinkling carts be filled from tanks only.

NASHVILLE MEETING OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE seventeenth meeting of the American Society of

OF MECHANICAL ENGINEERS.

THE seventeenth meeting of the American Society of Mechanical Engineers will convene in the city of Nashville, Tenn., on Tuesday, May 8, at 8 P. M., and will adjourn on Friday of that same week. The headquarters will be in the Maxwell House.

The exact details of allotment of sessions, etc., will be given on the docket which will also give the order of presentation of papers and which will be distributed in headquarters as a condensed programme.

The following papers are to be presented in the sessions and discussed: "Duty Trials of Pumping Engines," J. S. Coon; "Surface Condensers," Jay M. Whitham; "Large and Enlarged Photographs and Blue Prints," R. H. Thurston; "Proportioning Steam Cylinders," R. H. Thurston; "Automatic Regulator for Heating Apparatus," John T. Hawkins; "A Plea for the Printing Press in Mechanical Engineering Schools," John T. Hawkins; "A New Method of Inserting and Securing Crank Pins," C. C. Collins; "Estimating the Cost of Foundry Work," George L. Fowler; "A Safety Car-Heating System," Henry R. Towne; "Connecting Rods," William F. Mattes; "Notes on Warming Railroad Cars by Steam," William J. Baldwin; "A Foundry Cupola Experience," Frederick A. Scheffler; "The Best Form of Nozzles and Diverging Tubes," A. F. Nagle; "The Tetra Basic Phosphate," Jacob Reese; "Strains in Locomotive Boilers," L. S. Randolph; "Steam Excavators," W. L. Clement; "An Electric Speed Regulator," George H. Barrus; "The Effect of Circulation in Steam Boilers on Quality of Steam," George H. Barrus; "A Short Way to Keep Time and Cost," H. L. Binsse; "The Distribution of Steam in the Strong Locomotive," F. W. Dean; "River Practice of the West," John M. Sweeney; "A Persistent Form of Tooth," J. Burkitt Webb; "Wire Rope Fastenings," William Hewitt; "The Lateral Curves of Fishes as Offering Resistance," Harry de B. Parsons; "Mechanical Significance of Determination of Viscosity of Lubricants," J. E. Denton. Subjects and queries will also be presented for the topical discussions. Subjects and queries will also be presented for the topical discussions.

Special arrangements with railroad companies for reduced tates have been made, amounting to one and one-third fare instead of two for a round trip. For further particulars address the Secretary, F. R. Hutton, 280 Broad-

A WATER-MAIN BURSTS IN BOSTON.

THE 36-inch water-pipe that supplies the Fisher Hill reservoir from the Chestnut Hill reservoir burst in Beacon Street, Boston, on the night of the 5th instant, but was fortunately shut off so promptly that little damage was done beyond a local washout.

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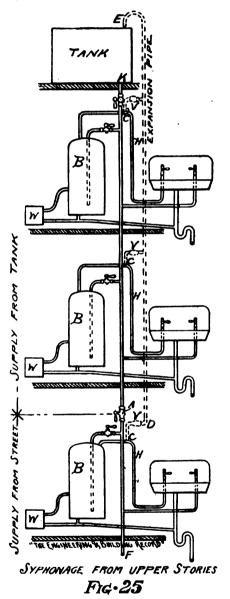


A LECTURE ON PLUMBING BEFORE THE NEW YORK TRADE SCHOOL.

No. II.

(Continued from page 280.)

In apartment houses where, boilers on several floors are supplied by the same vertical branch from the street main there is danger that if the lower stories use all the supply it may result in collapse of the upper boilers. This can be remedied by using an expansion-pipe, as shown in dotted line, Fig. 25, which will furnish air to prevent the possibility of a vacuum and consequent collapse. If this pipe is inadmissible vacuum-valves made to admit the air whenever there is any tendency to collapse may be used.



In Fig. 25, B B B are the boilers, W W W the water-backs, and H H II the hot-water service-pipes connected at C C C with the expansion-pipe D E, and fitted with swinging valves, V V V, that open only away from the boilers and will admit air when there is suction in the pipe. A is a stop-cock in supply-pipe F K.

Figure 19 shows an arrangement sometimes found, especially in stables, where, in order to secure a hot-water supply without expensive fittings, it is drawn directly from the water-back hot pipe without passing through any storage reservoir between water-back and faucet.

The trouble lies in the danger of burning or blowing up the water-back.

Frequently a coil of pipe is simply placed inside a round stove and connected at one end with the cold-water supply and at the other with the sink faucet.

This may answer if carefully watched and attended, but having no possibility of circulation requires frequent

drawing off, gives but a small supply of hot water, and is liable to burn out.

The New York Board of Health having required that each fixture shall be separately trapped, old systems are often altered in an attempted compliance, as shown in Fig. 16, where one trap at A was originally intended for both bowls and the trap B afterwards inserted and vented back to C on the vent-pipe from A. This makes a bad job worse, for the sewer-gas following the direction of the arrows finds an unobstructed entrance into the house.

This should be prevented as shown in dotted line, C D, by connecting waste-pipe from E to main waste.

In a tall building supplied with cold water from a storage-tank on the upper floor it is sometimes found impossible to draw water from the upper faucets.

This is occasioned by the great pressure in the bottom of the supply-pipe which forces the water through the lower faucet with such a velocity as to discharge it all as fast as the pipe can deliver it, provided the faucet happens to be big enough.

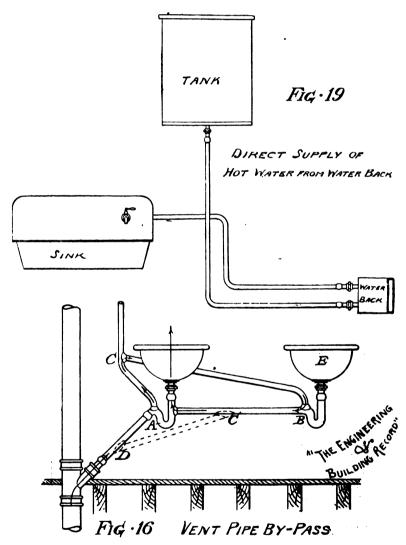
This is remedied by decreasing the size of the pipe from the top downwards. In a six-story house the pipe from tank to the fifth floor may be I 1/4-inch, thence to the fourth floor I-inch, thence to the third floor 1/4-inch, thence to the second floor 1/4-inch, and from the second to the first floors

The principal precautions are: (1) Placing them sufficiently deep in the ground; (2) keeping them away from outside walls; and (3) by properly felting them or packing in sawdust, mineral wool or other suitable material.

The bursting of pipes when they freeze is due to the expansion of the water, which increases its volume by about one-ninth, so that nine gallons of water when frozen would fill a 10-gallon vessel with ice, or ten cubic feet of ice when melted only produces about nine cubic feet of water.

The expansion of water in freezing has been determined by frequent experiments to be able to exert a pressure of about 30,000 pounds per square inch, an amount which compared with the 15 pounds per square inch exerted by a column of water 33 feet high, shows how impossible it would be for any pipe to stand it. Indeed, its tremendous power is illustrated by the practice in the Brooklyn Navy Yard of filling cannon with water, plugging them up, and allowing them to freeze, which bursts them into a thousand pieces.

If plumbing cannot be entirely protected from freezing, opportunity should be afforded for the emptying of pipes by proper grading to the lowest point where the danger ceases. When a pipe becomes frozen it may be thawed either by external heat, or, if it is straight and reason-



½-inch. This will furnish a proper supply at each faucet and prevent the lowest one from draining it away from all the rest.

When the house-supply is from a storage-tank in the top floor and the street-pressure will carry the water only part way up, it is often convenient to be able to draw at the lower faucets from either street or tank supply. This can be accomplished by putting a three-way stop-cock just below the level of street-water pressure and connecting it with the tank, the house-supply pipe, and the street-supply, so that while the house-supply is open turning the cock will admit street-water and shut off that from tank, or vice versa.

In this climate the freezing of water-pipes is a very serious danger, and since the Board of Health and Water Commissioners both lay the responsibility on the plumber and require him to prevent the necessity of letting water run to waste in order to prevent freezing, the problem of protecting water-pipes from frost is the most important and difficult one before the New York plumber.

ably short, an inaccessible pipe may be thawed by steam introduced through a rubber pipe and stop-cock with round waterway.

When pipes cross a floor over a ceiling it should always be protected from leaks by laying the pipes in a lead-lined trough, slightly inclined throughout its length, to a drippipe at either end that discharges in the cellar at the ceiling.

This precaution should always be observed, as the cost is trivial compared with the possible damage to the ceiling. It is, however, when possible, much better to avoid crossing the ceiling by running independent vertical lines up each side of the house.

Precautions should be taken to protect pipes from contact with fresh mortar, for the lime in it has a very corresive action on them.

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GRADUATING EXERCISES OF THE NEW YORK TRADE SCHOOL.

THE presentation of well-earned diplomas to members of last winter's classes formed the principal feature of the pleasant exercises held last Friday, April 6, at the Trade School building.

Col. R. T. Auchmuty, who has individually founded

and maintained the schools, presided at the exercises, which he opened by a brief and earnest address, reviewing the scope and progress of the schools, and referring to the influence which its pupils might exert on the solution of

great labor problems.

Mr. John Burns made some stirring remarks, commending the assiduity and progress of the pupils, encouraging their further efforts and assuring them of the support of their friends who are encountering some opposition in the

attempt to provide trade instruction.

attempt to provide trade instruction.

General Daniel Butterfield, James Gilroy, of the Plumbbers' Association; G. Gill, of the Master Stone Cutters' Association; Joseph Scott, Chairman of the Committee of the Master Painters' Association; John J. Tucker, of the Master Builders' Association, and Prof. Thos. Eggleston, of the Columbia College School of Mines, officiated respectively in the presentation of diplomas to members of the classes in bricklaying, plumbing, stone-cutting, house painting and frescoing, carpentry and blacksmithing.

The regular courses leading to diplomas in the different trades consisted of instruction and the performance of actual work for two and one-half hours each Tuesday and Friday evenings from October 26, 1887, to April 4, 1888, besides lectures, blackboard illustrations and explanations of special features of work, and the scientific and practi-

of special features of work, and the scientific and practi-

cal principles involved.

The diplomas were classified as first, second and third grade, and were granted to the pupils according to their standard as determined by their attendance, proficiency and answers to the questions of the final written examina-tion. The plumbing class also were given examples of defective arrangement and required to explain and corrrect

Membership in the bricklaying, stone-cutting and carpentry classes was restricted to boys from 16 to 21 years of age; the other classes were unrestricted, but the ages averaged about 18 or 19 years. The attendance was chiefly local, but quite a number came regularly from a considerable distance for the privilege of instruction, and all paid the tuition fee of from \$10 to \$20 for each course. There was also a day course of instruction in plumbing, which was well attended by pupils often from distant cities, whose desire for education and improvement led them to incur the expense of traveling, tuition and maintenance during the expense of traveling, tuition and maintenance during

The founder and teachers of this noble enterprise are justly proud of the zeal and good conduct of the classes. Order and attention have been universal; valuable tools and materials have been carefully and honestly used, and the workmanship of the pupils has been exceedingly creditable.

The schools are receiving constant enlargements and improvements for the season of '36-7. The receipts from the various classes were \$4,848.28, and the expenses \$9,515.90. The first stason opened with thirty pupils registered, and the last with 446; and the attendance has been even a little larger than that—viz., day class in allumbing 24 evening classes in plumbing 150; in brickplumbing, 34; evening classes in plumbing, 150; in brick-laying, 120; in carpentry, 28; in stone-cutting, 15; in plastering, 28; in blacksmithing, 13; in painting, 38; in tailoring, 31; total, 457.

The following pupils in the plumbing class received

Ine following pupils in the plumbing class received diplomas:

In Plumbing—Chas. Dunn, W. H. B. Bridgeworth, G. J. Coetz, E. W. Gross, G. Diemer, F. Kubischta, C. J. Pickett, D. D. Whitlock, Jr., W. J. Zimmer, A. C. Lum, Martin Carey, Edwin Mills, L. F. Madden, J. F. Bolia, R. C. Cassell, Pierce T. Murphy, Chas. Ross, S. F. McCormick, E. J. Coppers, J. M. Harrington, Jos. Murphy, Jr., G. E. Parsells, W. S. Lamb, H. A. Schneider, Max Friedman, F. A. Seelig, J. H. Palmer, Wm. Bailey, H. H. Schneider, J. W. Toomey, D. W. Ayeres, Wm. K. Beddow, E. P. Sands, V. E. Reynolds, W. C. Walsh, H. Boylhart, Al. Watts, H. Graves, Conrad Dietz, R. P. McGowan, August Seeger, John Laverty, John Hahn, George Maxwell, John Badanes, H. McLaughlin, J. H. Mersfelder, Frank J. Clarke, G. H. Pheasey, W. J. Lennahan, D. J. Dolan, Michael Hanley, W. Kelley, J. D. Sloan, M. J. Garrey, A. J. Moore, Dennis Sullivan, J. O'Brien, Chas. Read, Jeremiah Galvin, Isaac D. Simonson.

PHILADELPHIA MASTER PLUMBERS' ASSO-CIATION ON SOIL PIPE TESTS.

(Special Correspondence.)

AT the meeting of the Sanitary Committee of the Master Plumbers' Association, which was held on April 5, to discuss and prepare a report on the most desirable and efficient method of testing soil-pipes, it was agreed, in sub-stance, to recommend to the association that for all new work a pressure of three pounds to the square inch be adopted before the fixtures are attached, and that in work, whether new or old, where the fixtures were attached and in position a test of 2-inch water gauge pressure be made. The chairman of the committee was directed to prepare a report covering the matter and present it to the associ-

STATION J OF THE NEW YORK STEAM CO.

No. II. (Continued from page 279.)

CONTINUING the description of this building, commenced in our last issue, we give this week a floor plan, or rather horizontal section; showing the general arrangement of the main steam-pipes, taken immediately below the roof so high as to show no windows, and just above the coal-bins, whose floor is supposed to be removed so as to show more clearly the piping immediately over the boilers, of which the drums only appear.

Steam is taken from a point near the rear of the drums for the two-fold purpose of obtaining dryer steam and making better allowance for expansion.

From the peculiar construction of these boilers, as will be seen in the transverse section of the building, the circulation is very strong, and a powerful current of mingled steam and water rises into the front end of the drums from the water-tubes below, but from that point to the rear there is comparatively little ébullition in the drums, and the steam and water have opportunity to separate as they pass back to the place where the former is drawn off.

A cast-iron breeches piece, with 5-inch branches, unites each pair of drums and connects them with a 6-inch branch,

E, leading to the main steam-pipe, D, which is ten inches in diameter. The additional length of these branch pipes. obtained by taking steam from the rear of the drums, permits their expansion and that of the main steam-pipe without undue straining of joints. The main pipes conduct the steam to two separators or dryers, C C. These are upright cylinders, thirty-four inches in diameter and ten feet high, into the lower part of which the steam enters, and from which it escapes through a dry pipe extending up inside while the disengaged water is drained off.

The steam next passes through the meters B B. These are so arranged that the steam flows through a variable opening with a constant difference of pressure due to a weighted plunger supported by the passing steam. As the velocity is thus practically constant, it is only necessary to record the amount and duration of the opening in order to know the volume of steam that has passed through the meter. The amount of the opening is recorded by a pencil, moving across a strip of paper, carried by clockwork. As the transverse ordinates of the figure thus formed are proportional to the opening of the meter, and the longitudinal ordinates are proportional to the time, it follows from what has just been said that the area of the fig are will be proportional to the volume of the steam This area is measured by a modification of passed. Amstler's planimeter, and with the smaller meters on the same principle which are used to measure the steam supplied to customers, the steam bills are based on the reading of the planimeter, while the marked strip or meter chart is preserved for future reference and check.

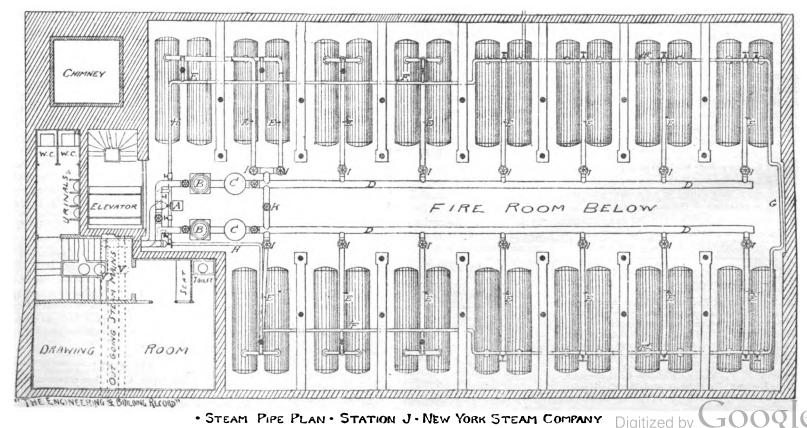
From the meters the steam passes down to the outgoing steam-mains, also ten inches in diameter, on which V V are the variators to allow for expansion. All the other pipes shown on this plan, except the one which goes to the pumps in the rear, are merely alternative connections to be used in case of accident or repairs. A is the ash chute,

As it is of vital importance that the steam-supply to so many customers who so absolutely depend on it should be continuous and secure, every precaution has been taken to prevent the apparatus from being disabled by any single accident.

Thus the main steam-valves I I are constructed so to close automatically in case the pressure in the boiler falls below that in the steam-pipe, by which, if a tube or joint should fail in any boiler, that boiler is immediately isolated and the others continue their work without inter-

In case the main steam pipes or any of their branches E E should be disabled, steam can still be taken from the boilers by the rear pipes F F, assisted, if need be, by the cross-connection G. As these are but four inches in diameter, it will take more pressure to get the same amount of steam through them, but that is not a serious matter. The cross-connection K has also been put in to cut out either separator or meter when necessary, and the various valves and connections between the meters and the outgoing mains are for similar precautionary purposes.

(To BE CONTINUED.)



Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

THE NIAGARA SHIP CANAL.

OSWEGO, N. Y., April 9, 1888.

SIR: The maps and estimates for the proposed Niagara Ship Canal, referred to in your issue of April 7, are based upon surveys made in 1867, not by myself, as there stated, but by the late Mr. James S. Lawrence, C. E., and by Mr. Stephen F. Gooding, C. E.

Will you kindly publish this correction?

Yours very respectfully,

WILLIAM PIERSON JUDSON.

RECORDS OF TESTS OF COMPRESSIVE STRENGTH OF CEMENT.

New York, April 12, 1888.

SIR: Will you kindly inform me where I can obtain any information as to the compressive strength of cement, and especially as to any experiments on the compressistrength of cement joints in heavy masonry?

C. E.

[Referred to our readers.]

WATER-WORKS CONSTRUCTION IN CALI-FORNIA.

FROM a letter of J. M. Graham, the Chief Engineer, we abstract the following data concerning work now in progress under his direction for supply of San Diego:

"The San Diego Flume Company are building an extensive system of works to supply water to city of San Diego and some other places; also a large amount for irrigation.

The natural flow of the San Diego River and other streams is diverted and carried 36 miles in a 4x6-foot flume to within 10 miles of San Diego, where a two years' supply for the city can be stored in a reservoir 500 feet elevation above tide-water. This reservoir will be filled in 40 days by the flume.

"A storage reservoir is also built in the Cuvamaca Mountains at an elevation of 6,000 feet; capacity, 4,000,-000,000 gallons, to be drawn on as the natural flow of streams may not be sufficient during dry seasons.

"The flume is the finest specimen of such work in the State, and is continuous (no ditching on the line), except one mile of tunnels, which are lined with masonry and plastered.

"Water is now running through 18 miles of the flume, and flume will be finished by July.

J. M. GRAHAM, "Yours truly, "Chief Engineer."

BRINGING WATER TO LIVERPOOL UNDER THE MERSEY.

To BRING the water from the Vyrnwy Dam to the city of Liverpool it is necessary to cross the Mersey River, and the arbitrator, Sir George Nares, appointed by the Board of Trade to fix the depth below the bed of the river at which the pipes must be laid, has decided that not less than 20 feet will be necessary.

As it would be impossible to lay the pipes at this depth owing to the character of the soil, which is running sand and silt, the engineers have decided to go down to a bed of boulder clay at a depth of from 80 to 100 feet below the river, where it is proposed to drive a tunnel about ten feet in diameter lined with cast iron.

Bids have been invited and the contract has been probably let by this time.

The rainfall in that vicinity has been so unprecedentedly small for some time past that the reservoirs supplying the city have little more than a third or a fourth of what they should contain at this time of the year, so that it has been necessary to restrict the supply of water to six hours a day, with a prospect of greater scarcity before the season is over, and many other large towns are even worse off.

NEW YORK BUILDING MATERIAL EXCHANGE OFFICERS.

THE Building Material Exchange held its seventh annual election at the Exchange rooms in Liberty Street on nual election at the Exchange rooms in Liberty Street on April 9. The following officers and trustees were chosen: George Moore Smith, President; James Rogers, Vice-President; Hiram Snyder, Treasurer; George M. Smith, James Rogers, Hiram Snyder, Nathan Peck, Oscar A. Gurnee, S. Wood Cornell, Walter Tomkins, Robert S. Sinclair, Hamilton V. Meeks, Richard R. Letourette, John J. Bell, Herman B. Homan and Sayres Hadley, Trustees. The treasurer's report showed the Exchange to be in a prosperous condition.

THE NEW YORK MUNICIPAL BUILDING PLANS.

It has been decided by the city authorities to invite the American Institute of Architects to submit a list of seven names from their number from which they may select a committee of three to act as judges upon the plans submitted for the new municipal buildings, noticed last week in these columns, to determine, first, whether a building should be constructed in accordance with any of the plans, and, second, whether any of the plans are entitled to the prizes offered, and in what order. The prizes are five in number, and are \$5,000 for the best, \$4,000 for the second, \$3,000 for the third, \$2,000 for the fourth, and \$1,000 for

The Mayor suggested that Professor Ware, of Columbia Ccllege, be appointed on the committee. It was afterward determined to assure the institute that the members of the committee selected would be properly remunerated for their services, and that, until the awards are made, no public view of the plans will be given.

ASBESTOS THEATRE CURTAINS.

THE London Engineer contains an illustrated description of the asbestos curtain for Terry's theatre, and also one designed for the Queen's theatre in Manchester. They are made of asbestos cloth specially strengthened by a fine wire running through each asbestos strand and stretched upon a counterbalanced iron frame sliding up and down in guides. A layer of asbestos cloth may be put on each side of the frame, leaving an air-space between.

SWISS WATER FOR PARIS.

THE London Morning Post says that a Swiss engineer, Herr Ritter, has submitted to the Paris municipality a plan by which the city may be furnished with an ample supply of water from an inexhaustible source—the lake of Neufchatel, Switzerland—at a cost \$60,000,000. Some time ago another engineer, M. Beau de Rochas, proposed to furnish Paris with water from the Lake of Geneva, at a cost of \$100,000,000, but the scheme was not accepted. Herr Ritter is more moderate in his estimate, and there is a probability of his success. The distance from the lake of Neufchatel to Paris is 312 miles, and the surface of the lake is 1,620 feet higher than the mean level of Paris, its total area covering 140 square miles. The water, which would flow with a speed of rather under 100 feet per second, would arrive at Paris at a temperature of 50° Fah.

Herr Ritter intends to draw off the water by an underground heading 262 feet below the surface of the lake, where it has a temperature of only 43°. The water would be taken through a tunnel twenty-two miles long under the Jura mountains, and thence in an arched conduit along the slopes of the hills to Paris, where it would arrive at an elevation of 394 feet, with a flow of 4,400 gallons per second, which would give a tremendous motive power. In this manner Paris could be furnished not only with an illimitable supply of excellent drinking-water, but also with the electric light in all the streets, and water-power in all the workshops at a reasonable price, independently of the advantages accruing to the districts through which the conduit would be laid, and which could also draw their supplies from the same source. Herr Ritter estimates that it would take six years to complete the works.

SUBSCRIPTIONS FOR BUILDINGS FOR RAIL-ROAD MEN.

THE New York Central and Hudson River Railroad has given the following Y. M. C. Associations along the line of its road the following gifts: East Buffalo, \$5,000; West Albany, \$2.500; DeWitt, \$1,000; total, \$8,500. These gifts are subscriptions toward the erection of buildings for railroad men at the points named.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	letropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	nickerbocker Gas-Light Company.	Equitable Gas Light Company.
April 7	25.37	20.35	21.65	30.35	29 81	24.08	.31.81

A PAPER CHIMNEY.

A NOVELTY in chimney-shafts is reported from Breslau. A shaft 54 feet high has recently been erected there, constructed entirely of solid blocks of paper cemented together. It is claimed that the shaft is both fire and lightning proof.

NOTES.

THE Minneapolis Board of Trade has adopted resolu. tions expressing its belief that the retirement of City Engineer Andrew Rinker at this time would be a public calamity.

MR. F. A. CALKINS, M. Am. Soc. C. E., has completed the plans for the sewerage system of New Rochelle, N. Y. and they have been accepted by the Board of Trustees They provide for the use of the separate system in most

MESSRS. E. L. CORTHELL, L. E. Cooley, H. B. Herr, W. P. Rice, and Mr. Kurth appeared before the U. S. Senate Committee last week in behalf of the Cullom-Breckinridge bill. Messrs. Corthell and Cooley, made arguments in its favor.

THE firm of Buck & McNulty, MM. Am. Soc. C. E., Civil and Mechanical Engineers, 53 Broadway, New York City, will be dissolved on May 1. Mr. Leffert L. Buck will continue in the same business at 18 Broadway, and Mr. George W. McNulty at 45 Broadway.

THE President sent to the Senate the following nominations in the engineer corps: Lieutenant-Colonel Cyrus B. Comstock to be Colonel; Major Jared A. Smith to be Lieutenant-Colonel; Major G. H. Ernst to be a member of the Mississippi River Commission, Vice-General Gillmore, deceased.

CALIFORNIA BITUMINOUS ROCK FOR PAVING.

OUR St. Paul correspondent writes that Mr. Ivan Prowattain, of Philadelphia, stopped in that city on his return from the Pacific Coast where he has been to inspect the bituminous rock found along the coast near Santa Cruz. He is to make a report to the City Council of Philadelphia, recommending the use of this rock for paving purposes and setting forth its advantages.

CHICAGO WESTERN SOCIETY OF ENGINEERS.

THE 247th regular meeting was held April 3. In the absence of the President, Mr. C. L. Strobel was made Chairman pro tem., L. E. Cooley, Secretary.

The following were elected to membership: Daniel Andrew With, Assistant Engineer, Town of Lake, Chicago. Ill.; Paul K. Richter, Engineer, Chicago Bolt and Forge Co., Chicago, Ill.; Edward B. Meatyard, Geneva Lake, Wisconsin.

A resolution was adopted approving the modified Cullom-Breckinridge bill.

CULLOM-BRECKINRIDGE BILL IN ST. PAUL. (From our Correspondent.)

ST. PAUL, MINN., April 9 .- For some time there has been before the Chamber of Commerce of this city awaiting final action a proposition asking the chamber to endorse the bill now before Congress establishing a Bureau of Harbors and Waterways. A counter proposition has been entertained in the shape of a petition which has been circulated in the West protesting against the proposed change. The Chamber of Commerce have not yet voted on the matter. This morning they received a letter signed by members of the Civil Engineers' Society of St. Paul to the effect that the society had endorsed the movement, and they asked the favorable co-operation of the chamber.

ANOTHER SYSTEM OF SEWAGE PURIFICA-TION.

A. M. DEFOSSE, of Brussels, has just patented a system f sewage purification. He, as is usual, claims that the cost is defrayed by the products. The process is, (1) precipitation by chemicals; (2) filtration through specially prepared turf, which is susceptible of cleansing and continual use; (3) filtration through a bed of spongy iron. After leaving the spongy iron the effluent passes to the river through a limestone bed.

PERSONAL.

MR. YEIJI NAKAJIMA, C. E., has accepted the position of superintendent of the construction of the water-works of Falls City, Neb.

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CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

ANN AFBOR, MICH.—The Students' Christian Asso-ciation has decided on the plans of Spier & Rohns of Detroit for their new building. The building will be 60x90, and cost about \$25,000.

MILWAUKEE, WIS.—E. T. Mix & Co., architects, of this city, have made contracts with the North-western Guaranty Company, of Minneapolis, to furnish plans and architect's services for the erection of their 12story office building this summer. The building 12sto be 132x155 feet on the ground, and will be furnished throughout for bank and office purposes. It will cost about \$2.50.000.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-viii-296.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

Burrillville, R. I.—Water.—Our correspondent writes: "We had a meeting in relation to the waterworks April 9, and, I understand, they appointed a committee to confer with different parties in relation to the cost and of building the water-works."

East Saginaw, Mich.—Sewers.—John J. Granville, City Engineer, writes: "Proposals for constructing sewers to the extent of about \$30,000 will be received in the course of two or three weeks. Sewers to be constructed in accordance with the sewerage plan adopted in 1886."

FRANKLIN, N. H.—WATER.—Town Clerk H. K. Smith writes us: "The town voted to leave the matter of water-works in the hands of a committee of five to investigate and report at some special me ting. No report has yet been made by the committee."

MILWAUKEE, Wis.—The City Engineer is preparing plans for the improvement of the sewer system of the Sevent enth Ward.

WARRIOR STATION, ALA.—WATRR.—Our correspondent writes: "Arrangements have been perfected so far as to the securing of the locality for stand-pipe and engine for the pumping of the water. We hope to be able to supply water by June 15. The stand pipe will be 800 yards from Warrior River, from which place we will handle the water."

ORLEANS, NEB.—WATER.—Concerning the water-works election here, our correspondent writes: "Our election will be he'd April 23. There will be no oppo-sition. Mr. Richardson, of Lincoln, will be evil engi-neer in charge of work. It will be let by contract.

ITHACA, MICH.—It is reported that Mason L. Brown, C. E., of Detroit, Mich., is preparing plans for a system of water-works to be established here...

Little Falls, N. Y.—An additional appropriation of \$50,000 will be made for work on the water-works system.

PARKDALE, CAN.—It is reported that a \$20,000 system of water-works is to be established here.

FREDONIA, N. Y.—It is reported that a system of sewerage is to be established here.

NATRONA, PA.—Address P. S. Brackenbridge for details of extensive water-works improvements at this place.

Moundsville, W. Va.—Water.—L. G. Brock, Town Clerk, writes about the reported water-works project here as follows: "I he matter of water-works has often been talked about in our town, but as yet nothing has been done, and I do not see any immediate prospect for doing anything in that line. We have a mound here nearly 100 feet high which could well be used to build a tank upon, but although we have 2,000 or more population, yet the town is so scattered, it covers so rrunch space, that efficient water-works would be costly."

CARTERVILLE, MO.—WATER.—The Town Clerk here writes us as follows: "Carterville and Webb City, which joins, are both in favor of water-works. Nothing of efinite has been done as yet, but is being talked of by both the city officials and every body else. There has been some St. Louis parities here, but nothing done so arr."

CENTRRVILLE, MD.—WATER.—Our correspondent writes: "The election to determine the water-works question did not take place April 3 as was at first proposed. There will be a special election held for the purpose, but it has not yet been decided when to hold it. When the election does take place I will let you know the result; also other particulars."

BATESVILLE, ARK.—WATER.—Town Recorder J. E. Rosenburgh writes us as follows: "A water and electric-light company has been organized, composed of the leading business men of our town, and an ordinance passed granting them certain rights and privileges and requiring them to have one-half mile main laid and supplying water to the citizens in two years from date of passage, April 7, 1888."

OMAHA, NEB.—It is reported that the sewerage system of this city is to be improved at a cost of \$100,000.

ELLENSBURG, N. Y.—It is reported that B. E. Craig & Co. will construct a system of water-works here.

CLYDE, N. Y.—WATER.—Our correspondent writes, under date of April 9, as follows: "No action has been taken concerning water-works excepting the village trustees called a meeting of the taxpayers which was held this P. M. I understand the vote stood two majority in favor, but what the intention of the trustees is now I am unable to answer. They may take further action and may let it drop where it is."

WINONA, MINN.—The proposition to expend \$20,000 improving the c ty water-works failed to carry at the recent election.

recent election.

NAHVILLE, TENN.—SEWERS.—City Engineer J. A. Jowett writes us as follows: "Our sewerage system is practically mapped out and we are spending about \$35,000 per annum in construction. The districts requiring it receive first attention. The work is not let as a whole, but each sewer, or section of a sewer, is let as a separate contract. Our water-works are now receiving our special attention. The natural fittering-gallery and pump-wells are finished. The Holly-Gas-kill Co. are preparing to erect a new engine. The reservoir is being rapidly constructed. The total estimated cost of the work, including main pipe-line, is \$1,000,000. The main-pipe line to the reservoir will not be let before next spring."

INDIANAPOLIS, IND.—WATER.—F. S. W. Duns, Vice-President of the Indianapolis Water Company writes:
"We will lay about 12,000 feet of mains, from 6 to 12 inch. Contracted for the pipe with Addyston Pipe Co., Cincinnati, O. Have contracted with the Holly Mig. Co. for two engines, 350 horse-power each, to run our pumps power devices. Co. for two engines, 350 horse-power each, to run opumps, now driven by water, when we are short water.

Madison, FLA. -W. T. Davis can give details of the roposed system of water-works for this place.

NASHVILLE, TRNN.—E. L. Gregory is said to be at the nead of a project to erect an improved system of water-works for this city, at a cost of \$1,200,000.

CHIFTON, O.—Bonds are to be issued for extending the sewerage system here.

PEMAQUID, ME,—It is reported that the Pemaquid Land Co. will establish a drainage system here.

Minneapolis, Minn.—The Board of Trade has recommended larger water-mains.

FORT RILEY, KAN.—For details of a system of water-works to be erected here, address Captain Pond, Quartermaster's office, as above.

HELENA, MONT.—WATER.—J. W. Wade, City Engineer, writes us about water matters here as follows: "G. N. Miller, San tary Engineer, of St. Paul, is preparing plans. City bonds to raise \$150,000 have not yet been sold, but will shortly find buyers. Then it is probable that city will advertise for bids in the constructive work. It is not expected that the system contemplated when complete will cost less than \$300,-000."

WATER-WORKS. -- See our Proposal Column for information regarding water-works and water-work sup-plies at the following places: New London, Conn., Asbury Park, N. J., Kingston, Ont., Fort Riley, Kan., Toronto, Can.

BRADY, TEX.—It is reported that water-works are be established here.

· BRIDGES.

BLOOMSBURG, PA.—County Commissioner W. E. Knox writes: "For the purpose of erecting an iron wagen bridge over the Susquehanna River here a company has been organized, with a capital of \$50,000, a charter applied for, and all the preliminary steps taken. A letting will be had about May 1, at which time all bridge parties will have an opportunity to bid."

DANBURY, N. C.—An iron bridge is to be erected here by the County Commissioners. Ed. Pfaff can furnish details.

OREGON CITY, ORE.—The County Commissioners will bund a bridge over the Willamette River, at this place, to cost \$24,000.

New London, Conn.—A new bridge is to be erected here by the New York, Providence and Bosson Rail-road Company. J. W. Miller, General Manager, New York City, can give details.

NEW YORK CITY. - The Union Bridge Company, of this city, has been awarded the contract for the foun-dations, masonry and superstructure of the bridge to be built by the New York, Providence and Boston Railroad Company over the Thames River at New London, Conn.

GUNTERSVILLE, ALA.—A bridge is to be erected over the Tennessee River at this place by the Tennessee and Coosa Railroad Company.

NASHVILLE, TENN.—It is reported that a bridge is to be built at the canal at Cumberland Mountain by the Nashville, Chattanooga and St. Louis Railroad Company.

RAILROADS.

MONTANA.—Cable roads are talked of at Butte and at Phillipsburg, in Montana, and, apparently, with a fair prospect that they will be built at one or both places. That at Butte is 7,000 feet long, to cost about \$70,000, and that at Phillipsburg 3 miles long, to cost about \$300,000.

GAS AND ELECTRIC-LIGHTING.

WEBSTER CITY, IA.—A company of capitalists from Des Moines will erect a gas-plant here this summer.

OSKALOOSA, IA.—The gas works here are to be enlarged to the extent of \$15,000.

ST ALBANS, N. Y .- An electric-light plant will be established here.

Paris, Ga.—The sum of \$25,000 is to be expended on improving the gas-works here. Address Paris Gas and Electric Light Co.

BARTOW, FLA.—An electric-light plant is to be established here.

STREET-WORK AND PAVING.

TOPEKA, KAN.—Several streets of this city are to be aved during the summer. Macadam and cedar block paved during th will be wanted.

SOMERVILLE MASS.—About \$50,000 is to be expended on paving, etc., the streets of this place.

OMAHA, NRB.—Several miles of streets are to be repaved this summer.

CLIFTON, O.—Extensive improvements are to be made to the streets here.

BIDS OPENED.

New York City.—The following was the only bid submitted for supplying and laying cast-iron waterpipes, hydrants, gates, etc., supplying and laying sewer-pipes and sub-irrigation tiles, constructing manholes and sewage tanks, supplying and setting up steam-pumps, wells, connections, etc., at Central Islip, Long Island, N. Y., opened April 7 by the Department of Public Charities and Correction: James Moore, \$29,072.

New York City.—Plumbing.—The following bids for reconstruction of the plumbing at the City Prison were opened April 7 by the Department of Charities and Correction: P. Carraher, Jr., \$6,453; James Armstrong, Jr., \$6,650; C. Nally. \$6,837; John Spence, \$7-654; John Regan, \$7,847; George Cody, \$9,350; James Moore, \$13,000.

554; John Keyan, \$7,847; George Cody, \$9,350; James Moore, \$13,000.

Yonners, N. Y.—Engine and Boilers.—The following bids for a 2,000,000-gallon pumping-engine and boiler were opened March 20 by the Board of Water Commissioners; engine high-pressure: Gordon & Maxwell Co., \$4,000; Knewle's Steam-Pump Co., \$4,000; Knewle's Steam-Pump Co., \$4,600; Knewle's Steam-Pump Co., \$5,300; The Volker & Felthousen Manufacturing Co., \$3,175. Compound condensing engine: Gordon & Maxwell Co., \$5,600; Knowles Steam-Pump Co., \$6,635. Compound condensing engine: Gordon & Maxwell Co., \$6,600; Knowles Steam-Pump Co., \$8,681; H. K. Worthington, \$6,537; Deane Steam-Pump Co., \$8,700; National Iron-Works, \$6,800; The Volker & Feithousen Manufacturing Co., \$6,350.

For two steei boilers, 66 inches diameter, with 66 3½-einch tubes 16 inches long: Payne & Co., \$2,500; McNeil & McI achlan, \$3,200; Cunningham Iron-Works, \$7,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,250; Nichola & McI achlan, \$3,200; Cunningham Iron-Works, \$7,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,250; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$7,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,250; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,250; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,200; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,200; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,200; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Whittier Machine Co., \$3,232; The Bigelow Co., \$3,200; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,750; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,000; Nichola & McI achlan, \$4,000; Cunningham Iron-Works, \$2,000; Nichola & McI achlan,

was awarded April 6 to H. R. Worthington, and the contiact for boilers has not yet been awarded.

Hamilton, O.—Bridge.—The following proposals for the construction of an iron bridge superstructure over the Miami River, at Poastlown, were opened April 5 by the Butler County Commissioners:

Pittsburg Bridge Co., Pittsburg, Pa., \$24,000; Smith Bridge Co., Toledo, O., six plans from \$75,400 to \$18,-000; Wrought Iron Bridge Co., Canton, O., three plans, \$51, \$52,00 and \$52 per lineal foot; Groton Bridge Co., Groton, N. Y., \$20,800 and \$22,000; P. E. Lane, Chicago, Ill., \$14,827; Variety Iron Works Co., Cleveland, O., \$14,000; Indiana Bridge Co., Muncie, Ind., \$17,909; Penn Bridge Co., Beaver Falls, Pa., \$18,515; Massillon Bridge Co., Bassillon, O., \$20,000 and \$18,500; Brilin Iron Bridge Co., Binghamton, N. Y., \$21,500 and \$29,000; Milwaukee Bridge and Iron Works, Milwaukee, Wis., \$14,899; Mt. Vernon Bridge Works, Mount Vernon, O., \$16,900, \$10,245 and \$19,265; Columbia Bridge Co., Dayton, O., \$45,500 per lineal loot; King Bridge Co., Cleveland, O., \$14,675, \$16,404, \$16,575, \$16,925, \$16,573; for iron joists, \$1,350 additional; Missouri Valley Bridge Works, Leavenworth, Kan., \$15,775.

The Commissionersawarded the contract to the Smith Bridge Co. for \$16,500.

The contract for the masonry was awarded to Cummings & O'Connor, of Indianapolis, Ind., at \$10,-

983 50.

MILWAUKER, WIS.—DREDGING.—The following bids have been submitted to the Board of Public Works for the contract to build the inlet for the flushing tunnel and to do the necessary dredging. C. H. Starke, 27 cents per cubic yard for dredging and \$21,000 for the construction of the inlet; Wm. Forrestal, 35 cents for dredging and \$23,250 for the inlet. The contract will be awarded to Starke should the bid prove to be within the limits of the appropriation.

NEWPORT, KY.—The following bids for change of effluent system of water-works were opened April 2 by B. R. Morton, Water-Works Superintendent: P. Murray, Cincinnati, O. \$11,095; Owen Patterson, informal, Baltimore, Md, \$12,227 50; J. Hahn, Newport, Ky., \$14,620; J. Barter, Newport, Ky., \$16,385; Thomas J. Peter, Cincinnati, O., \$16,442.50; C. J. Limrick, Newport, Ky., \$16 405.

The contract was awarded to P. Murray.

SAVANNAH, GA.—RAILROAD.—The contract for building the Belt Vine for the City Suburban Railroad of this city has been awarded to T. William Harris & Co., of No. 2 Nassau Street, New York City.

CHICAGO, ILL.-The contract for five new tripleexpansion condensing pumping-engines, with a capacity of 15,000,000 gallons per twenty-four bours each, was officially awarded by the Commissioners, April 7, to Edward P. Allis & Co., of Milwaukee, Wis., the total cost given being about \$369,785. PPILADELPHIA, PA.—DREDGING.— The following bids for dredging docks in the Port of Fhiladelphia were opened by the Board of Port Wardens April 2: National Dredging Co., Wilmington, Del., 273 cents per cubic yard; Frank C. Sumers, Philadelphia, Pa., 273/c.; Thomas G. Locke, Linwood, Pa., 32C.; American Dredging Co., 27c.

BOSTON, MASS. - CURRSTONES - The Park Commis BOSTON, MASS.—CURBSTONES.—The Park Commissioners have received the following proposals for supplying granite curbstones: Cape Ann Granite Co., \$3.64% per lineal toot; Rockport Granite Co., \$2.89; James A. Colson, \$3.04; A. A. Libby & Co., \$3.60; James J. Vernon, \$2.87; Lanesville Granite Co., \$2.75, The contract was not awarded.

MINNEAPOLIS, MINN.—Bridge.—R. M. Douglass has been awarded contract for bridge across Bossett's Creek at \$2,280.60.

Creek at \$2,280.60.

St. Paul, Minn.—Steam-Heating, Eic.—Bids for the building of the new reformatory at St. Cloud were opened April 3 as follows:
Steam-heating—Allan Black, \$4,003.80; E. H. Murphy, \$4,703; Thomas Davis, \$4,338.84; Holland, Thompsin & Co., \$4,035.44; F. S. Martin, \$5,242; C. F. Parmlee, \$4,356; E. F. Usborne & Co., \$5,057.32.
Cell-work—Haugh, Ketcham & Co., \$3,320.9; Diebold Safe and Lock Company, \$11.560.

Cast and Wrought fron Work—Haugh, Ketcham & Co., \$27,679.40; Clark, Raffen & Co., \$3,200; St. Paul Foundry Con pany, \$5,275; Paul Roofing and Coinice Company, \$5,275; Pernsylvania Slate Company, \$9,874; Scribner-Libby Co., \$0,632.

Plumbing—Allan Black, \$7,452.50; W. J. Freaney, \$7,200; J. G. Holmes, \$5,075; W. W. Sykes & Co., \$6,270; J. P. Adamson, \$5,400; Prendergast Bros., \$7,550.

Stone and Brick Work—W. Arnold & Co. (all work except iron), \$112.398; George J. Grant, \$71,400; Matt Breen, \$1,650.

Excavation—G. J. Grant, \$1,660; Matt Breen, \$1,650.

Carpenter-work—G. J. Grant, \$8,125; Matt Freen,

,650. Carpenter-work—G. J. Grant, \$8,125: Matt. Ereen, \$8,92 \$8,921.
Fainting and Glazing—George Nesbett, \$1,633; G. Winding, \$1,927.77.

MILWAURER, WIS.—DREDGING.—C. H. Starke & Co. have been awarded the contract for doing the dredging in the rivers of this city for the coming season. The following were the bidders: W. T. Casgrain, co cents per cubic yard for doing the dredging in the Milwaukee River, 18½ cents per yard in the Menomonee River, and 18 cents in the Kinnichinnic River; D. O. Dickson, of Recine, 20 cetts per yard for the Milwaukee River and 18 cents for the Kinnickinnic and Minomonoe Rivers; C. H. Starke & Co. will get 18 cents per yard for the Milwaukee River and 18 cents for the other two.

for the other two.

Louisville, Ky.—The following bids for plumbing and gas-pipe, steam heating, water-works, iron and wire work, aid boilers for the West Tennessee Hospital, at Boliver, Tenn., were opened April 2:
Plumbing and gas-pipe.—J. W. X. Brown, Memphis, Tenn., \$10,147; H. L. Rose, Memphis, Tenn., \$0,778; Moony & Bairn, Nashville, Finn., \$12,320; Kain & Demerick, Nashville, \$12,326; C. H. Humbert, Nashville, \$12,326; K. H. Nashville, \$10,537; S. I. Pope & Co., Chicago, Ill., \$9,900.

Steam heating.—J. W. X. Brown, \$17,557; Andrew Schwartz, \$10,740; Moony & Bairn, \$22,103; Kain & Demerick, \$23,750; Ryan & Shia, \$23,426; S. I. Pope & Co., \$18,370; Kelly & Jones, Pittsburg, Pa., \$18,667; Iron Range and Manufacturing Co., Nashville, Tenn., \$10,662.

Iron Range and Manufacturing Co., Nashville, 1enn., \$10,662.
Water-works.—J. W. X. Biown, \$3,410; Andrew Schwartz, \$5,249; S. I. Pope, \$4,500; Keily & Jones, \$3,232; Iron Range and Manufacturing Co., \$4,087. Iron-work.—Livermore Foundry and Machine Co., Memphis, Tenn., \$8,055; Iron Range and Manufacturing Co., \$5,781; Lane Brothers, Newark. O., \$8,747.
Boilers.—Livermore Foundry and Machine Co., \$5,224; Andrew Schwartz, \$4,472; S. I. Pope & Co., \$5,220; Kelly & Jones, \$3,062.
Wire-work.—Dow Wire-Works, Louisville, Ky., \$2,2100.

Work complete.—Brown & Livermore, Memphis, Tenn., \$41,350; H. S. Jackson & Co., Memphis, Tenn., \$55,500.

HOBOKEN, N. J.—WATER-PIPR.—The following bids for furnishing 10,000 feet of 6-inch water-pipe were opened by the Water Commissioners, April 5: Mellert Foundry & Machine Co., \$28.75 per ton of 2,240 pounds; R. D. Wood & Co., \$29.50 per ton of 2,240 pounds; Warren Foundry and Machine Co., \$5.11 per length of 12 feet 3 inches; Thomas McKenna, \$4.70 per length of 12 feet 3 inches, Gloucester Iron Works, \$29.79 per ton of 2,240 pounds; Reading Foundry Co., \$5.12 per length; McNeal Pipe and Foundry Co., \$5.12 per length; McNeal Pipe and Foundry Co., \$5.12 per length. The proposals were referred to the Committee on Supplies.

mittee on Supplies.

St. Paul, Minn.-Street Work.—The Hoard of Public Works has awarded the following contracts; grading Fry Street to Evans Bros., \$2,156; grading Ulive Street to Thornton & Shaw, \$4,093; paving Sibley Street and levee with cedar blocks to James Forrestal, \$7,380. Also to James Forrestal for wooden sidewalks, 3,500,000 feet of lumber, relaying 2,000 feet, 3,000 cubic yards of excavation and 500 cubic yards of rubble masonry, approximating \$62,550, \$62,550; to the Eureka Stone Company, for hexagonal block sidewalks, 150,000 square feet with curbing, approximating \$37,205; to Lauer Bros. for stone sidewalk, 25,000 square feet with curbing, approximating Congress Street to Michael Lux for \$0,412; grading Clermont Street, James Claffey, \$4,772; grading Plum Street, to McArthur Bros., \$2,280; grading Plum Street, to McArthur Bros., \$2,280; grading Marshall Avenue, to Dale & Bumgardner for \$48,907. The following contracts were awarded to S. P. Folsom, Jr., the tonds having been approved by the City Attorney; paving Arundel Street, \$12,600; paving Mackubin Street, \$77,465; paving Dale Street, \$21100; paving Minnesota Street from Eighth Street to Summit Avenue, \$14,950.

GOVERNMENT WORK.

MACON, GA.—The following bids for the interior finish of the Court-House were opened April 11 by the Supervising Architect of the Treasury: McCarthy & Baldwin, \$23,275; Corbin McK. Grant, \$23,438; D. A. I. Sull.van, \$30,499.

1. Sull.van, \$30,490.

WASHINGTON, D. C..-Schedule of bids for airpumps and engines and repairs to gun shop opened April 10 by Bureau of Provision and Clothing, Navy Department, by Paymaster Fulton: The Deane Steam Pump Co., of Holyoke, Mass., \$1,85 for one No. 1 and two No. 2 Davidson's Air-Pumps; The Davidson Steam Pump Co., \$1,475 for one No. 1 and two No. 2 Davidson Air-Pumps; Armington & Simms, Providence, R. 1, for engines as follows: one at \$753.35, one at \$8.66.50, on at \$875.50, and one at \$2,84: six complete with fixtures and foundations in place, \$10,821; B. W. Payne & Sons, New York, one at \$490 and one at \$100; Rowland A. Robbins, New York, \$2,999 for repairs to gun shop.

WASHINGTON D. C.—The following bids for fur-

WASHINGTON, D. C.—The following bids for furnishing stone for the cellar and sub-basement of the Library Building were opened April 7 by the Library Commission:

Library Building were opened April 7 by the Library Commission:

Dover Marble Company, Dover, N. Y., plan No. 1, \$481,000; plan No. 2, \$582,000; plan No. 3, \$2 63 and \$3 per cubic foot, and \$77,50 per cubic yard. Mount Waldo Granite-Works, Frinkfort, Me., plan No. 1, \$207,737; plan No. 2 \$107,500; plan No. 3, \$1 63 and \$1.63 per cubic foot, and \$15.85 per cubic yard. Hallowell Granite-Works, Hallowell, Me., plan No. 1, \$224,316; No. 2, \$228,040; No. 3, \$1.87 and \$1.87 per cubic foot, and \$20 per cubic yarl. Stoit, Hall & Bangs, Washington, D. C., plan No. 1, \$257,760; No. 2, \$237,600; No. 3, \$1.25 and \$1.52 per cubic foot, and \$1.62 per cubic yard. Hodwell Mich Public April 100, 1, \$500,000; No. 3, \$1.25 and \$1.52 per cubic foot, and \$10 per cubic yard. Hurst & Treanor, New York, plan No. 1, \$340,000; No. 2, \$440,000; No. 3, \$2.42 and \$2.13 per cubic foot, and \$23 per cubic yard.

MISCELIANFOLIS

MISCELLANEOUS.

MINNKAPOL S, MINN.—A soldiers' monument, to cost 3,000, will be erected. W. G. Nye is secretary of the \$3,000, will commission.

ST. JOHN, N. B.—The Channel Subway Co. has been incorporated. The promoters are A. A. Stockton, C. Hurd Peters, C. E., and T. R. Jones. It is intended to construct a single or double tunnel under the harbor of St. John, N. B., between St. John and Carleton.

NEW CORPORATIONS.

Тив Chicago and Western Illinois Railroad Cor pany, Chicago, Ill. Capital, \$3,000,000. Henry A Gardner, and others, incorporators.

THE Jackson Avenue Street Railway Co., Kansas City, Mo. Capital, \$174,000. J. J. Green, and others incorporators.

THE Rockport, Booneville and Princeton Railroad Co., Rockport, Ind. Capital, \$500,000. J. G. Eigenman, and others, incorporators.

THE Cleveland, St. Louis and Kansas City Railway Co., St. Louis, Mo. Capital, \$1,500,000. F. J. Matthews, and others, incorporators.

The San Diego, Cuyamaca and Fastern Railway Co., San Diego, Cal. Capital, \$7,000,000. R. W. Waterman, and others, incorporators.

THE San Bernadino Central Railway Co., San Diego, Cal. Capital, \$540,000, A. B. Hotchkiss, and others,

incorporators. THE Bridewell Automatic Gas Lighting and Extinguishing Co. San Francisco, Cal; capital, \$6,000-000. E. S. Irwin, and others, incorporators.

THE Kansas Pump Co, Wichita. Kan ;capital, \$20,000. George P. Glaze, and others, incorporators.

THE Ruttan Warming and Ventilating Co., Chicago, Ill.; capital, \$20,000. Sterling L. Bailey, and others, incorporators.

The Mutual Accumulator Co., Jersey, N. J.; capital, \$100,000. Richard Arnold, and others, incorporators.

The Omaha, Dodge City and Southern Railway Company, Topeka, Kan. Capital stock, \$7,000,000. R. W. Evans, George B. Coy and others.

The Higgins Park Railway Company of Topeka, Kan. Capital stock, \$100.000. Directors: W. W. Gavitt, Hiram Higgins, R. E. Heller and others.

The Kaw Valley Bridge Company, of Kansas City; capital stock, \$100,000; directors. Morris B. Snyder, E. R. Fisher, W. J. Strong, K. P. Snyder, of Kansas City; Calvin P. Fox, of Kansas City, Mo. The purpose of this concern is to build wood, iron, and stone bridges.

PROPOSALS.

(Centinued from page viii.)

APPIL 12, 1888.

SEALED PROPOSALS will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 20 clock P. M., on the 22d day of May, 1888, for the labor and materials required for the interior finish, including the furring and lathing, plastering, joiner work, wood flooring, stairs, marble work, glass, hardware, painting, polishing, plumbing and gas-fitting, in the Court-House, Post-Office, etc., building at Vebraska City, Neb., in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, Permanent Exhibit and Exchange, Chicago, Ill.; Builders' Exchange, Cincinnati, O.; Michanics' Exchange, St. Louis, Mo.; Builders' and Traders' Exchange, Kausas City, Mo.; Builders' and Traders' Exchange, Louisy-le, Ky.; Mechanics', Dealers' and Lumbermen's Exchange, New Orleans, La., and Builders' Exchange, Minnapablis, Minn. Each bid must be accompanied by a certified check for \$500. WILL. A. FRERET, Supervising Architect.

STEAM LAUNCH.—GALVESTON, TEX.—Proposals are wanted, until May 5, for building a small wooden passenger steamer, of about 100 tons burden. Address O. H. Erust, Major of Engineers, U. S. Engineer office, as above,

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper chippings and other items of interest.

ABBRRYIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apart nent-house: len, tenement; c, each e, owner; a, architect; b, builder; fr, frame.

NEW YORK.

210-14 W 125th st, br store; cost, \$20,000; 0, Henry Morganthal; a Buchman & Duser.

123d st, 85 w Lenox av, 3 br dws; cost, \$45,000; o, A B Van Dusen; a, Chas H Beers.

Se cor ist awand 1sth st, br dws and stores; cost, \$15,000; o, Peter Butterly; a, Marshall & Walter. W s Bathgate, 150 w 175th st, br dws; cost, \$8,000; o, Mrs Matilda L Sheldon; a, John E Kirby.

Ws West st. foot of Beach, br storage freight; cost, \$35,000; o, Old Dominion SS Co; a. R P Staats.

N w cor 114th st and 4th av, 4 br dws; cost, \$85,000 all; o, John B Cannon; a, F A Minuth.

587-89 Walton av. 2 br dws; cost, \$18,000 all; o, Anna T Dale; a, J S Dale.

2329-31 1st av. 2 br dws; cost, \$25,000 all; o, Chas S Warner; a, B W Warter.

Ns 145th st, 100 e 10th av. br dw; cost, \$12.000; 0, Donnellon & Barnes; a, Thom & Wilson.

S s 116th st, 100 e 8th av, 4 br dws; cost, \$8,000 all; o, Oscar C Ferris; a, Wm B Tuthill.

S s W 131st st, 235 w 5th av, 5 br dwe; cost, \$55,000 all; o, Edward C Butcher; a, Walker & Bates. Es 8th av, 24 s 127th st, br dw; cost, \$16,500; o, Catharine Preusser; a, Theo E Thomson.

406-408 West 33d, 2 br flats; cost, \$22,000 each; o, Dunne Bros; a, F A Minuth.

211 E 51st, b 4 flat with store; cost, \$22,000; 0, H A Sohl; a, Thom & Wilson.

54th, s s, oo e 4th av, br flat; cost, \$20,000; o, J C Graham; a, Thom & Wilson.

132 E 114th, b s flat; cost, \$15,000; o, N J Reville; a, Thom & Wilson.

220 222 E 118th, br church; cost. \$12,000; 0, First German Baptist Church; a, H F Kdburn.
42-44 F. 84th, 4 story and basement br and stone convent; cost, \$40,000; 0, Sisters of Charity of St Vincent de Paul, Mt Vernon, N Y; a, W Schickel & Co; b, not selected.

2,160, 2d av, 5 story br flat; cost, \$20,000; o, Weil & Meyer, 305 E 57th; a, G B Pelham; b, J Van Dolsen.
4th av, n w cor 116th, b s flats with stores; cost, cor \$25,000, other \$20,000; o, Louis Wirth; a, E Wenz.

Manhattan av, s e cor 112th, 2 b s dwells; cost, \$22,-000 each; 0, Mary Ann Petit; a, J H Taft.

130th, n s, 100 e oth av, 6 br dwells; cost, \$5,500 each; o, W C Boyd; a, Cleverdon & Putzel.

641 643 F 155th, 2 dwells; \$4,000 each; 0, J C Smith; a, Andiew Spence.

Union av, w s, too s 149th, 4 fr dwells; cost, \$4,500 each; o, harrisonville Co-operative Bidg Assoc; a, Andrew Spence.

St Anns av, w.s., 109 s 141st, stone chapel; cost \$40,000; o, trustees St Anns Church of Morrisania; a and ii, D C Weeks & Son.

S w cor 125th and Madison av, br dwells and stores cost, \$72,500; o, Moritz Cohn; a, C Abbott and French & Co.

384 Grand st. br dwells and stores; cost, \$12,000; 0, Mrs Helen Burnet; a, J Dunn.

Ns 114th, 220 e 5th av, 3 br dwells and stores; cost, \$48,000 all; o, Thos J Jenkins; a, Geo W Walgrove.

Ss 83d, 32 e Av A, br dwells and stores; cost, \$18,000; o, Fred Braender; a, Edward Wenz.

538-542 Morris av. 4 br dwells and stores; cost, \$10,-200 all; o, Mathus Sullivan; a, Wm Rusche.

156 Broome, br dwells and stores; cost, \$18,000; o, K Giblins and Ch Lingheimer; a, Rentz and Lange.

BROOKLYN.

Starg, s s, 175 w Waterbury, 6 fr tens, store under one; cost, each, \$4,000; o, Mr Schneider.

George, ss, 125 e Central av, 5 fr ters; cost, \$4,000; and c, J Bossert.

Lafayette av, s s 282.6 w Lewis av, 4 b s dwels; cost, each \$4.500; o, F Sloat; b, C Wood and T Tibbals. S s Dean st, 250 w Brooklyn av, br dw; cost, \$8.000; o, F I Kunball; a, Allen Kenway.

N s J-fferson av. 100 w Evergreen st, 2 fr dws; cost, 6,000 all; 0, Mr. Dehler; a, John Platte.
W s Vanderbilt av, 435 w Myrtle av, 3 br dws; cost, 24,000 all; 0, Con Donnellson; a, S R Dunal.

N s Madison st, 100 w Lewis av, 4 brick dws; cost, 22,000 all; o, F B Bryant; a, I D Reynolds.

E s Roebling st. 50 n Division, br dw and store; cost, 8,000; o, C A Schumacher; a, E F Gaylor.

N s Greene av, 275 w Stuyvesant av, 2 br dws; cost, \$11,000 all; o and a, Walter F Clayton.

S w cor Monroe st and Lewis av, br dw; cost, \$9,000; o and a, D R Norris.

35-37 Lorimer, br foundry; cost, \$8,000; o, William Stieghts; a, F Holmberg.

S s Monroe, 22 w Lewis, 5 br dws; cost, \$28,000 all; o and a, D R Norris.

Flushing av, 4 fr dws; cost, \$17,000 all; o, H Stuberry; a, not given.

N s Hooper st, 80 w Myrtle av, brick dw and stable; cost, \$10,000; o, A D Band & Co; a, Th Engelhardt.

cost, \$10,000; 0, A D Band & Co; a, 1h Engelhardt.
Cor Fullton and Hoyt sis, hr store; cost, \$50,000; 0,
Nancy B Wheeler; a, W H Beers.
S s Herkmer, 20 c Hopkinson, 6 br dw: cost, \$19,500
a'l; 0, H C Baker; a, Amzı Hill.
N s Herkimer, 175 e Hopkinson, 7 br dw; cost, \$23,-500 all; 0 and a, as above.

Kent av and Cross, br boiler shops; cost, \$8,420; o, Nassau Gas Lt Co; a, Thos S. Beuson.

Same as above, to manufacture gas; cost, \$41,708: o and a, as above.

S s Lexington av, 350 e Reid av, br dw; cost, \$15,-000; o, Wilson Bohannan; a, Geo Bohannan. 33-37 Lorimer, 3 fr dw; cost, \$12,600 all; o, Win Stiglitz; a, Frank Holmberg.

BUILDING INTELLIGENCE.

Sw cor Fulton and Bushwick av. 5 fr dw; cost, \$17.-o all; o, Mrs Masterhill; a, H Vollweiler.

N « Vernon av, too w Tompkins av, br flat; cost, \$12,000; o, Samuel Peden, Ir.
N s Jefferson, 600 e Reid av, 5 br flats; cost, \$20,000 all; o, G Revere; a, Amzi Hill.

S s Concord, 50 w Jay, br flat; c st, \$14,000; 0, Jas Sullen; a, J G Glover

N s Crescent and Glen, 7 fr dw; c st, \$17,500 all; o, Jose Quinn.

Se cor Hancock and Marcy av, 2 br dw; cost. \$45,-000 all; o, M W Morris.

S s Atlantic av, 240 w Troy av, 2 br dw; cost, \$10,000 ail; 0, Wooly; a, Geo Damen.

Es Marshall, 300 s Hudson av, br dw; cost, \$15,000; o, Brooklyn Gas Lt Co; a, W Mooney.

MISCELLANEOUS.

MINCELLANEOUS.
MINNEAPOLIS, MINN.—The following is a summary of Building Inspector Baumann's report for the first three months of the present year: Miscellaneous, \$286,059; brick stores, \$233,000; brick veneered stores, \$4,700; frame stores, \$4,7.500; brick dwellings, \$112,000; brick veneered dwellings, \$53,500; two-story frame dwellings, \$53,725; one and one-half-story dwellings, \$10,000; one-story frame dwellings, \$5,070; additions and repairs, \$99,458; barns, \$18,785; total, \$1,183,747.

SCRANTON, PA.—Plans are now ready for a \$50,000 Catholic college to be erected here.

TORONTO, CANADA.—Address John Kent, trustee of Woman's Hospital, for details of a building to be erected at a cost of \$25,000.

ROCHESTER, N. Y.—The insane asylum here is to have an addition to cost \$45,000.

SING SING, N. Y .- A \$40,000 school house is to be

MANISTEE, MICH.—A Congregational Church is to be erected here at an estimated cost of \$45,000. Details can be had by addressing the Rev E B Fair-

GENESEO, N. Y .- A \$15,000 Catholic church is to be erected here.

PROVIDENCE, R. I. -22 permits for buildings costing less than \$7,000.

ALLEGHENY, PA.—Arch, 2 br dw; cost, \$10.500; 0, Miss C Scott; a, Alston & Herbert; b, R J Graham.

WAUSAW, WIS.—The Catholics of this place will erect a \$30,000 church.

YOUNGSTOWN, O.—It is probable that the mem-bers of St John's Episcopal Church will soon begin the erection of a church to cost between \$60,000 and t00,000. The matter is in charge of the Rev. F B

WILLIAMSPORT, PA.-Nothing over \$7,000 in

WORCESTER MASS.—Burncoat, fr dwell; cost, \$5,000; 0, Wm Lancaster; a, Fuller & Delano; b, O M Ball.

HUTCHINSON, KAN.—Updegraff, McCurdy & Zimmerman will erect a \$25,000 building here.

RICHMOMID, VA.—It is reported that a company has been organized here to erect a \$200,000 hotel.

CLEVELAND, O.—Radcliff & Co. will build a dry dock in the old river bed this season to cost about

ST. LOUIS, MO.—Iowa and Sidney sts, br school; cost, \$15,000; o, St Francis Congregation; b, sub et.

Broadway and Angelica, 3 adj br dwells; cost, \$12, 000; o, L Kohmel; b, H Schulte. Broadway and Lafayette, 2 adj br flats; cost, \$13,-000; o, L. Ottenad; b, J. Stauder.

KANSAS CITY, MO.-W W Perkins, br residence; cost, \$25,000.

ost, \$25,000.
W.T. Matthews, 92-story fr residences; cost, \$13,-

ller & Burgeweger, 4 and 5 story br building; cost, estimated \$60,000. Emerson School building; cost, \$25,000

Plans are completed for three school buildings that will cost \$75,000.

VASSAR, MICH —\$25,000 worth of building will be done nere. The Central Hotel, the Blackmore building, Emerson & Bird's shoe store and other stores will be erected.

EDDYVILLE, IOWA.—The Kipler building will be erected here at a cost of \$20,000.

CINCINNATI, O.—Canal st, 53 bldgs; cost, \$10,000; o, Corona Oil Co.

BALTIMORE, MD.—St Paul and 4th sts. women's col ege gymnasium; cost, \$30,000; 0, 1st M E Church; b, B F Bennett On North and Collington avs, 57 2-story brick bidgs; o. J W Beadford & Co

On Chester st, 38 2-story br bldgs; e, same as

On Townsend st, 12 2-story brick bldgs; o, same as above

F s Park av. bet Wilson and North avs; 3 3-story br bldg; 0, R E Deffenderfer. Patterson av, nr Fremont, 3-story br bldg; o, I H

Gay, bet Mott and Aisquith, 3-story br bldg; o, Henry Klitch

TOPEKA, KAN.—Wm C Knox & Co. will erect an office block here, to cost \$50,000 Joseph Black will erect a \$20,000 residence

ROCKVILLE, CONN.—The 2d Congregational Church will build a \$25,000 edifice A business block with 7 stores will be built by Mr. Fischer, at a cost of \$25,000

BUILDING INTELLIGENCE.

BEAVER DAM, WIS. - \$10,000 will be raised by Baptist Society for a ladies' hall on Wayland Unit pus.

AMESBURY, MASS. -8 carriage factories #10, built here at a cost of \$50,000.

MILWAUKEE, WIS. - 284-86 Pearson, double by cost, \$7,000; o, Frank Niezerowski.

HARRISBURG, ILL .- \$10,000 worth of store, a

ARNPRIOR, ONT, -The town hall will be been a cost of \$10,000.

DETROIT, Mich. - Woodward, br store; cost \$1 coo; o, S D Miller; a, G W Lioyd; b, \$1 Bay, 87 Watson, br dw; cost, \$2,000; o, F Simons; k, 1 C Varney; b, W H Holland.

46 Jones, br dw; cost, \$7,000; o, W H Boles, and b, as above. 491 Brush, br dw; cost, \$7,500; o, H Strasbe, a, as above; b, J Finn.

121 Lincoln, br dw; cost, \$7,000; o, H Zatell, as above; b, W H Carpenter.

74x Trumbull, br dw; cost, \$7,000; 0, | D Earls as above; b, W H Hollands.

roo Montcalm, br dw; cost, \$7,000; 0, Chas But-a and b, as above.

33 Hancock, br dw; cost. \$7,000; 0, G W Loote and b, as above. 43 Rowena, br dw; cost, \$7,500; o, Mrs Jacquib; and b, as above.

84 First, br dw; cost, \$7,000; o, J A Jones; a above: b, M Scholl.

Elizabeth, br dw; cost, \$20,000; o, Allen Bro. i and b, as above. Trombley, br factory; cost, \$30,000; 0, Mich kg: Co; a, Scott & Co; b, H Carew.

DETROIT, MICH.—Wight, br shop; cost, \$7,00.
Mutual Gas Co; a, Mason & Rice; b, H Cars
E izabeth, br dw; cost, \$7,000, 0, G Stenbe; a,
Speir & Rohos; b, W Reich.

747 Jefferson, br dw; cost, \$10,000; 0, T Schart a, G W Lloyd; b, A Albrecht. Putnam, br dw; cost. \$7,000; o, R F Reaust, a Miles; b, E Reynolds.

Reid pl, br dw; cost, \$7,000; o, H M Kitik; kill W Meyers; b, G Helms.

ROXBURY, MASS.—A Unitarian Churci to ex MINNEAPOLIS, MINN.—The North Side Sur-School building will be erected, work to be as-menced this spring. Estimated cost, \$40,000.

BOSTON, MASS.—Be'levue Terrace, wooder to cost, \$13,500; o, S M McNeil; a and b, McNeil Bros.

Bellevue, nr Quincy, wooden dw; cost, \$7.00.
Botsford R Ciarke; a, Ernest N Boyden; b, 113
S H Whitney.

ORTONVII.I.E., MINN.—A Masonic temple of grante will be errocted.

ST. PAUL, MINN.—Architect Walter Ife is at set on plans for several large buildings, all to be metit this spring. A house of flats, to be built on dark Avenue by Mr. Morse at a cost of \$4000, a 21 building, to be built by Mr. Horasby in West Deaul, \$12,000; a three-story brick business beach be erected on Mississippi Street, concern Main Airy, by J. E. Stryker, \$25,000.

BEAVER FAULS, PA.—The Pentsylvania Rained Company will, at an early date, begin the credual of an elaborate freight and passenger depot here.

MILWAUKFE, WIS.—575 Cass at, br dwell and na-sical conservatory; cost, \$25,000; o, Anson Edic S w cor Juneau av and Ieffersonst, double to 20. cost, \$12,000; o, Juhn R Drake.

Whitefish Bay, hotel, pavilion, bowling alicy, and park; cost, \$80,000; o, Col Cooligan. 23 buildings less than \$7,000.

ST PAUL, MINN-W 7th, nr View, 2 story br bo 35; cost, \$10,000; o, J Dietsch.

Aurora, near Arundel, 2 story br store; cos. \$2.000; 0, J Morris. Lee, near Drake, 2 story fr store; cost, \$16,000; h W Banholzer,

Rice. near Atwater, 2 story fr store; cost, \$10,000, o, R J Lewis. Exchange, near 6th, 3 story br dwell; cost, \$12,000 o, C F Ropp.

HOLYOKE, MASS. - Main st. addition to block. 3 stories, for stores and tenements; o, Clovis Robert.

NEW YORK CITY.—The New York World will erect a new building on Park Row, adjoining the New York entrance to the Brooklyn Bridge. The estimated cost of the structure is \$1.000,000.

PHILADELPHIA, PA. -3 2-story dws; b, Valestis:

2 2-story dws; b, Chas Ross 36 2-story dws; b, John M Sharp.

o 2-story dws: b. James C Carey. 4 2-story dws; b, Mart n Hetzel,

story mill and show room; o, Charles J Jarden 18 2-story, 3 3-story dws; b, N Shoemaker

5 3-story dws and stores; b, George Henvis. 3 3-story dwa; o, J G Amos.
3 2-story dws; b, J Marshall Haslan.

2 3-story dws; b, Charles J Mclivain.
2 3-story dwells and 15 2 story dwells; b, Boxton dwells; b, Dalmar & Moaison.
2 2 story dwells; b, Dalmar & Moaison.

5 3 story dwells; b, Charles I McIlmin.

with 7 stores will be built by Mr. 10 3 story dwells; b. John M Sharp.

Digitized by

THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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TYPHOID FEVER AND WATER-SUPPLY.

At the Congress of Hygiene at Vienna, Professor Brouardel read a paper on the propagation of infectious diseases by drinking-water; and, among his proofs of such propagation, cited the increase of typhoid fever in Paris when the impure water of the Seine was furnished for drinking instead of the much purer spring-water which is usually used for this purpose. This particular branch of his argument has been criticised by the Chief Engineer of the Paris Water-Supply, M. Bechmann, in a paper entitled "Les Eaux de Paris et la Fièvre Typhoide," which was presented to the Society of Public Medicine.

Professor Brouardel had stated that in 1886 there was a temporary deficiency in the pure water-supply, that from July 20 to August 7 the Seine water was distributed in certain quarters, and that the number of persons affected with typhoid who were admitted to the city hospitals rose from 40 for the week ending July 24 to 150 for the week ending August 7, and fell to 80 for the week ending August 21. M. Bechmann replies to this that the substitution of river for spring water was only made in three wards of the city, while the statistics show that at the time referred to by M. Brouardel there was an increase of mortality from typhoid all over the city, and that this increase was, if anything, greater in the wards supplied with springwater than in those supplied by impure water, and that hence there is no evidence that the change in the water-supply had anything to do with the fever outbreaks. The figures and diagrams which he gives do not prove anything particularly except that typhoid fever existed throughout the city, and he seems to have over-looked the fact that Prof. Brouardel had based his conclusions, not on the number of deaths from the disease; but on the number of cases of it which entered hospital. M. Bechmann does not deny that it is desirable that the water of the Seine should not be furnished for drinking purposes, but he considers that his branch of the service has been attacked and is in arms to defend it, claiming that it has not been proved that typhoid has been spread by the Seine water.

It is, however, very seldom that positive proof in such cases can be furnished; the best that can be done is to show that it is more or less probable that the disease has been due to a certain cause, the practical point being to estimate these probabilities with reference to the cost of preventive means. It would certainly seem that the probability that the water of the Seine may cause disease has been shown to be so great that it should not be supplied to the city for drinking purposes, and that Paris should take the necessary steps to avail itself of the irreproachable sources of supply which M. Bechmann states have been acquired in 1884.

THE LIGHTING OF THE SUEZ CANAL.

As the increasing requirements of commerce have outgrown the capacity of the Suez Canal, the management have decided to double its width and increase its depth and also to light it, so that it can be used by night as well as by day. As the latter can obviously be much more cheaply and quickly done, and will alone double the commercial capacity of the canal, it will be proceeded with at once.

The canal consists of long straight reaches connected by curves. For the reaches, accord-

ing to the London Times, the leading or range lights will be white, of sufficient power to be usefully visible at a distance of six or eight miles and placed where possible at the intersection of the centre lines of two adjacent reaches so as to enable vessels to keep strictly in the centre of the channel. If this is not possible, they will be so screened as to be seen only from the reach with which they are in line. On curves the lights called channel lights are to be placed alternately on either side of the centre of the channel and at a uniform distance from it. Those on the Asiatic side will be green and those on the African side will be red. They are to be fixed on buoys or standards according to circumstances. If on buoys the Pintsch system will be used, and compressed oil-gas will be used for all lights. All ships navigating the canal at night must be provided with some approved system of electric-lighting.

NEW YORK'S URGENT NEED OF THE QUAKER BRIDGE DAM.

IT is gratifying to note, even at this late day, that the New York Times has come to realize the pressing necessity of a work that this journal has been urging for years-namely, the construction of a reservoir of adequate capacity to store the water needed to supply the new aqueduct now nearly completed.

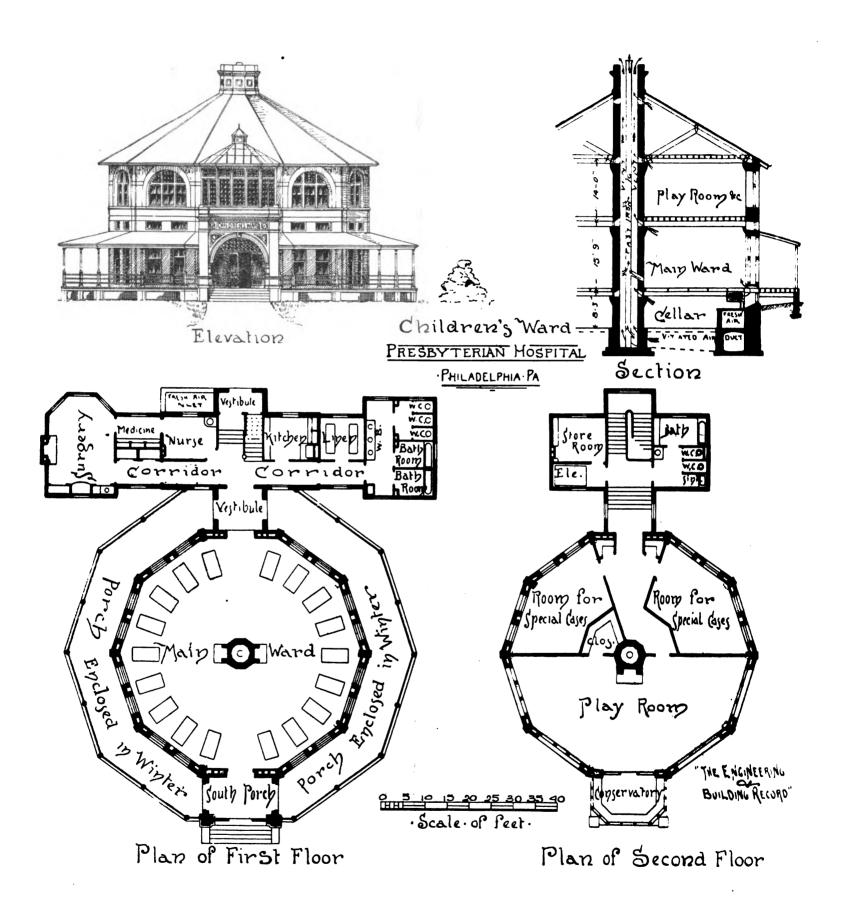
Without such adequate storage capacity the new aqueduct will be worse than useless, for, as has been well pointed out by the Times, it will merely enable the people of New York to use up more rapidly their present inadequate supply, and thus hasten a water-famine, which will be all the more keenly felt because of the preceding abundance.

When, in 1883, a commission was appointed to take measures to secure an increased supply of water for the city, it was promptly recognized that additional capacity both of storage and conduit would be required, and that simultaneously, either being almost entirely useless without the other. About the aqueduct there was fortunately no material difference of opinion or chance for alternative plans, and, as has been said, it is nearly completed. The dam, however, has been less fortunate. Although its necessity was obvious, and the proper site for it at Quaker Bridge early pointed out, conflicting interests caused obstructive opposition, and it was not until within a year that the commission finally decided on the Quaker Bridge site and requested their engineer to prepare plans for a dam in that locality. This has been carefully and, we believe, satisfactorily done, but now another difficulty has arisen.

Although there seems to be little question that the dam as designed will answer all requirements, it is strongly urged in certain quarters that by making certain changes in the plan, involving, it is admitted, additional expense, the dam can be made stronger and will look prettier.

One of the commissioners has, from the first, favored this proposed modification, and, in view of the magnitude of the interests involved and the unprecedented size of the structure, the commission were perhaps justified in calling in, as they recently have done, Messrs. Joseph P. Davis, J. James R. Croes, and William F. Shunk to advise them further on this point. When these gentlemen shall have rendered a verdict, which we trust will be as speedily as practicable, it is to

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THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES

A COUNTRY HOUSE

be hoped it will be accepted as final, and the work be proceeded with at once.

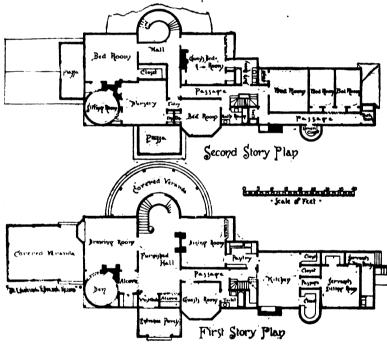
The delay already incurred by the commission exposes a million and a half of people to great discomfort and even danger, which must at best continue for some time, but its prolongation for an unnecessary day would be most reprehen-

BROOKLYN BRIDGE TERMINAL FACILITIES.

For the present the controversy over the respective plans for improved terminal facilities of the Brooklyn Bridge is settled by the unanimous adoption by the Bridge Trustees of the report of their committee on terminal facilities, of which Mr. T. C. Clarke, Mem. Am. Soc. C. E., was the expert member. This report we print in full on another page. They have dwelt mainly on the large item of expense for acquiring real estate involved in adopting the Wellington plan, taking the view, in which we think most citizens will concur, that such a sum of money would better be used for the building of another bridge.

The discussion over this problem, and the able way the matter has been presented to the public by Mr. Wellington, cannot but have the effect of drawing attention to the inevitable floor of the toilet-room is also of tiles. The plaster work throughout is of hard sand finish. There is ample capacity for twenty-seven beds-eighteen in main ward, four in each of two rooms for special cases, and one in a crouproom on the second floor, where there is also a large playroom, half the size of the main ward, with conservatory attached over the south porch.

The warming is by steam at low pressure, generally "indirect," but with direct radiation in the surgery and medicine room, vestibules, conservatory, and secondfloor toilet-room. The fresh air is admitted through the inlet on the west side of the north entrance, at 8 feet above ground level, to a masonry duct of 20 square feet area, which extends all around the outer wall of the ward at the level of the basement floor, and which is entirely shut off from the basement. The radiators are hung to the basement ceiling directly under each of the flues, and are enclosed in galvanized sheet-iron boxes, to which the fresh air is admitted from the duct below through galvanized-iron necks 12 inches square to each flue. There is a damper-valve in each neck. The openings into the ward are sixteen in number located under the sills of the windows, which extend to within 7 inches of the floor. The riser of each of these window-sills forms the mouth of the warm-air flues, and each is covered by three 6x18-inch valved registers. A propelling-fan is placed in the freshair duct near its outer end, and connected by belt to its engine, which is placed outside the duct in the basement. Tests with the anemometer give an average velocity of dis-



FLOOR PLAN OF A COUNTRY HOUSE.

future occupation of King's County for residen-The time distance map prepared tial purposes. Mr. Wellington, with the New York City Hall as a centre, forcibly suggests the importance of beginning other bridges, if not tun-Doubtless New York will oppose an expenditure of this sort on the ground that it would increase the taxable value of another county at the expense of this city. The effect, however, of the discussion will be to hasten the consolidation of the two cities. That accomplished, this phase of the problem would be eliminated

OUR ARCHITECTURAL ILLUSTRATION. A COUNTRY HOUSE-R. H. ROBERTSON, ARCHITECT, NEW YORK.

CHILDREN'S WARD, PRESBYTERIAN HOS-PITAL, PHILADELPHIA.

This building has recently been completed at a cost, inclusive of furnishing, of about \$35,000. It has been erected by Mrs. John Wanamaker in memory of her mother, Harriet Erringer Brown, and has been presented by her to the managers of the hospital.

The material is pressed brick and terra-cotta trimmings, with slate roofs. The floor of main ward is of iron beams carrying hollow tile flat arches, intended for a flooring of tiles, but afterwards changed to hard white maple. Main ward is wainscoted with tiles six feet high, as is also the toilet-room in east wing of the office building in rear. The

charge at the register with the fan at sixty revolutions of 192 feet per minute, the temperature of the incoming air being about 110°. The windows of the ward have double sash, with a space of 8 inches between the glass, and each window has a transom over it, the supports of which are flush with the ceiling of the ward and which open above the roof of porch. There are also transoms extending to the ceiling over every door in the building. The vitiated air of the ward is removed, artificially, through ten cold flues in the angles of the walls, each 9x13 inches, which discharge into a duct, eighteen square feet in area, directly under the fresh-air duct (there is a brick arch and concrete and cement floor between the two ducts), and which has two connections, across and under the floor of basement, into the base of the central aspirating shaft. This shaft is four feet internal diameter and is sixty four feet high. The top is entirely open. It has in it a coil of 150 lineal feet of 1-inch diameter steam-pipe to accelerate the discharge of air, and has also three open fireplaces connected with it, two in the main ward and one in the play-room over it. The ten vitiated-air flues in the outer walls have each a valved register opening 12x17 inches at floor and 12x12 inches at ceiling, and there are also ten valved register openings, 9x12 inches each, into the stack itself at the ceiling of the ward. The anemometer showed an average outgoing current at the floor openings of these ten flues-ceiling registers all closed-of 165 feet per minute; and a velocity in the contracted throat of the fireplaces—no fire on—of 355 feet per minute. Temperature in room, 72°. The play-room and the two special care rooms, on the second floor over main ward, are warmed

and ventilated in the same manner and on the same scale and showed similar results.

The fresh-air supply to the nurse's room, linen-room, and toilet-room in the office building is taken through sheetiron ducts from the main fresh-air duct, and the ventilation is by means of "Barker" registers in the flues, which are connected together in the loft and carried into the brick flues of the kitchen chimney.

In connection with the plumbing advantage was taken of the tall chimney of the boiler-house, some 215 feet from the children's ward, to dispense with traps, leaving the fixtures entirely open, and connecting a ventilating-pipe from the main trunk of the underground drainage into it. It is, of course, expected that the fire in this boiler-house will be constant every hour in the year, so proper draught is expected at all times by the designers. The only traps used are one at the foot of each rain water conductor, and one running trap on the main drain before it joins the city sewer in the street.

The building has been erected from the designs and under the personal supervision of the architects, Messrs. John McArthur, Jr., and John Ord.

MATTHEW ARNOLD ON ARCHITECTURE IN AMERICA AND THE NAMING OF AMERICAN TOWNS.

(From The Nineteenth Century.)

THE charm of beauty which comes from ancientness and permanence of rural life the country could not yet have in a high degree, but it has it in even less degree than might be expected. Then the Americans came originally, for the most part, from that great class in English society among whom the sense for conduct and business is much more strongly developed than the sense for beauty. If among whom the sense for conduct and business is much more strongly developed than the sense for beauty. If we in England were without the cathedrals, parish churches, and castles of the Catholic and feudal age, and without the houses of the Elizabethan age, but had only the towns and buildings which the rise of our middle class has created in the modern age, we should be in much the same case as the Americans. We should be living with much the same absence of training for the sense of beauty through the eye, from the aspect of outward things. The American cities have hardly anything to please a trained or natural sense for beauty. They have buildings which cost a great deal of money and produce a certain effect—buildings, shall I say, such as our Midland Station at St. Pancras; but nothing such as Somerset House or Whitehall. One architect of genius they had—Richardson. I had the pleasure to know him; he is dead, alas! Much of his work was injured by the condition under which he was obliged to execute it. I can recall but one building, and that of no great importance, where he seems to have had his own way, to be fully himself; but that is indeed excellent. In general, where the American's succeed best in their architecture—in the art so indicative and educative lent. In general, where the Americans succeed best in their architecture—in that art so indicative and educative of a people's sense for beauty—is in the fashion of their villa cottages in wood. These are often original and at the same time very pleasing; but they are pretty and coquettish, not beautiful. The mere nomenclature of the coquettish, not beautiful. The mere nomenclature of the country acts upon a cultivated person like the incessant pricking of pins. What people in whom the sense for beauty and fitness was quick could have invented, or could tolerate, the hideous names ending in ville—the Briggsvilles, Higginsvilles, Jacksonvilles—rife from Maine to Florida; the jumble of unnatural and inappropriate names everywhere? On the line from Albany to Buffalo you have in one part half the names in the classical dictionary to designate the stations. It is said that the folly is due to a surveyor who, when the country was laid out, hapto designate the stations. It is said that the folly is due to a surveyor who, when the country was laid out, happened to possess a classical dictionary. But a people with any artist sense would have put down that surveyor. The Americans meekly retain his names, and, indeed, his strange Marcellus or Syracuse is perhaps not much worse than their congenital Briggsville.

AMERICAN PUBLIC HEALTH ASSOCIATION.

THE sixteenth annual meeting of the American Public Health Association will be held at Milwaukee, Wis., No-

vember 20 to 23.

The Executive Committee have selected the following topics for consideration at said meeting: (1) the pollution of water-supplies; (2) the disposal of refuse matter of cities; (3) animal diseases dangerous to man; (4) maritime quarantine, and regulations for the control of contagious and infectious diseases, and their mutual rela-

tions.

The Local Committee of Arrangements has already commenced work to insure a large and profitable meeting. All communications relating to local matters should be addressed to Robert Martin, M. D., Commissioner of Health, Milwaukee, Wis.

Mr. Henry Lomb, of Rochester, N. Y., now well known to the American public as the originator of the "Lomb Prize Essays," offers, through the American Public Health Association, two prizes for the current year, on the following subject: "Practical Sanitary and Economic Cooking, Adapted to Persons of Moderate, and Small Means." lowing subject: "Practical Sanitary and Economic Cooking Adapted to Persons of Moderate and Small Means."
First prize, \$500; second prize, \$200.
For terms and conditions address Dr. Irving A. Watson, Secretary, Concord, N. H.



BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXXI.

(Continued from page 213.)

OIL RIVET FURNACES AT THE FORTH BRIDGE WORKS.*

COAL furnaces and hand-bellows were found to be inadequate for the requirements of the special riveting plant The former occupied too much at the above works. space, and interfered with work going on above them, while the latter do not give a uniform heat to the rivets and are too costly. To supply the want, several forms of burners and furnaces were made, of which the illustrations represent the latest and most approved design. The oil consumed is distilled from the waste gases issuing from blast-furnaces, and though the price has considerably increased since the introduction of the lucigen lamp, it is still a cheaper fuel than coal for rivet heating. Figs. 1 and 2 are sections of the furnace, which weighs 25 cwt., and measures 6'6"x2'4"x1'9". It is an iron box made up of 1/4inch plates, with angle-iron framing, lined with fire-brick, and provided with three openings at N, with sliding doors for placing and removing the rivets. A fire-brick arch is built about three inches below the top plate of the furnace, thus leaving a passage along which the air necessary for combustion is led, receiving on its way a considerable amount of heat. The admission of air is controlled by two small doors on the end of the furnace at M. The heated air comes into the combustion or heating-chamber just above the entering jet of oil, and out at the opposite end through a short 6-inch funnel. The oil-tank, not

CEMENT MORTARS FOR USE IN PUBLIC WORK.*

No. 1V.

(Continued from page 289.)

THE results showed that Portland cement mortar, whose time of setting is lengthened by the addition of sand, or lime, or both, suffers severely in loss of tensile strength by the action of frost, and that such loss becomes greater as the proportion of sand or lime is increased; further, that a quick-setting Portland cement will indurate in spite of the frost, provided that it be protected therefrom for two days after having been tempered, and that it be as dry as possible before exposure to the cold. It was also found that the mixing of such materials with brine renders the mortar more capable of resisting the influence of frost, and that this statement likewise holds true for slow-setting compounds, such as I cement, I lime, 3 sand. Mortars thus prepared and mixed with fresh water instead of brine, and kept for two days at a temperature of + 41° Fah., and then exposed to frost, lost nearly all strength, so that even after four months pieces could easily be broken off from the briquettes with the fingers; whereas, when tempered with strong brine, their strength after seven months was about fourteen times greater. Accordingly, if the mortar can be kept from freezing for a few days by the use of salt or brine, so as to allow the setting to take place, much

It may also be deduced from these experiments that when it becomes absolutely necessary to lay masonry in freezing weather, quick-setting Portland cements, mixed with small proportions of sand and water, should alone be employed; and when a satisfactory quality of work is expected or required, the use of brine or salt should be resorted to, as well as the protection of the newly laid masonry at night by means of adequate coverings. In case, however, that the temperature is lower than + 23° Fah., even these precautions will not prevent more or less

OIL RIVET FURNACE AND BURNER FORTH BRIDGE WORKS $Fig \cdot 3$ 5-43/4 PASSAGE BRICK HEATING CHAMBER

shown, contains about fifteen gallons, or sufficient to keep the furnace going about four hours. From it a flexible hose leads to a connection on the side of the burner at D, Fig. 3, to which the oil is forced by an air-pressure of twenty pounds per square inch, maintained in the tank, while air at the same pressure is supplied to the burner at O.

K

מ- 6

FIG . 1 SECTION ON I-K

M PASSAGE

The flow of oil and air is regulated by stop-cocks on each pipe, and their proportion is further controlled by adjusting the distance between the cap R and the tip S on the air-tube T, which slides through the stuffing-box U, and is moved in or out by the wing-nut P, while prevented from turning by the guide V.

The air-jet atomizes the oil, driving it in a fine spray into the combustion-chamber, where it meets the heated air already mentioned. The heat produced is very intense, being sufficient to melt the surface of the fire bricks if not properly controlled. The quantities of air and oil can be so nicely adjusted as to produce either an oxidizing or a reducing flame. For rivet heating the latter is preferable. and a little smoke should always be issuing from the fun-The burner is of brass, and is fastend by jam-nuts X Y to a small bracket, L, at the end of the furnace.

THE following additional engineers for work in placing the Nicaragua Canal line have arrived, from New York, at the headquarters of the Surveying Expedition: J. H. Covode, J. Clyde Power, chiefs of parties: Benjamin F. Bates, First Assistant Engineer; E. D. Very, Henry J. Dodge, second assistants; George F. Pohlers, Rodman and Draughtsman; W. H. Pearlbrook, Rodman. damage. Under such circumstances, moreover, it is some evident that the stones or bricks should be free from snow Under such circumstances, moreover, it is selfor ice and as dry as practicable; also, that all the materials, including the sand and cement, be free from frost by being kept at a temperature above the freezing point for some days before being used in the work. The safest rule, however, is to cease operations with mortars of any kind during the prevalence of frost.

FIG.2 SECTION ON G-H

HE ENGINEERING & BUILDING RECORD'

In a paper read before the American Society of Civil Engineers in July, 1886, its author, Alfred Noble, C. E., states that "in the construction of the lock at the St. Mary's Falls Canal, the laying of masonry was discontinued about October 20 of each year, on account of the frequent recurrence of freezing weather. On the last day of the work done in 1877, mortars made of Portland cement and of a good quality of American natural cement were used in adjoining portions of the same wall. Both mortars were mixed in the proportions of I cement to I sand, and The following the masonry was laid during a light rain. The following spring, the surface of the Portland cement mortar was sound, showing perfectly the marks of the rain drops, while the natural cement mortar was disintegrated to a depth of three or four inches." Mr. Noble also mentions agent of three or four inches." Mr. Noble also mentions a few other cases where Portland cement mortar was used in laying masonry during very cold weather without affecting the subsequent induration of the mortar noticeably. The inference to be drawn from his paper is, that if it becomes imperative to use mortar in freezing weather, Portland cement should be used.

Similar effects of frost wars also noticed by Mr. Francis

Similar effects of frost were also noticed by Mr. Francis Collingwood, C. E., on the Rosendale cement mortars, mixed in the proportion of 2 sand to 1 cement, used for the masonry of the East River bridge, sinche states that "the tops of the various pieces of masonry were always gone over carefully in the spring, the concrete which had been put in late, would usually be found disintegrated to a depth of from one to four inches, but below this it was

*Abstract of a report by the Executive Board of the City of Rochester, N. Y., prepared by Emil Kuiching, M. Am. Soc. C. E.

found sound. The rule seemed to be that it was unsound only so far as it was exposed alternately to freezing and thawing; and wherever it had taken a set before freezing. and had not been thawed out for some time, it was sound."
The experience of Mr. George S. Morison, C. E., with cements as given in his discussion of Mr. Noble's paper. is in full accord with what was therein stated, and in his exis in full accord with what was therein stated, and in its ex-tensive practice as a designer and builder of large bridges, he uses Portland cement exclusively in all places where the mortar is liable to freeze before setting. Mr. Eliot C. Clarke, C. E., also mentioned that in experimenting with concretes of Rosendale and Portland cements, which had been exposed to the weather for three years, he found that the former were injured and disintegrated from year to year, while the latter were not affected at all.

Recent expressions of opinion from many other excel-lent authorities respecting the action of frost on cement mortars are to the same effect as above recited. It is generally agreed that the freezing of freshly prepared cement mortar will not destroy its capacity to harden after becoming thawed, but exactly how much its cohesive and adhesive strength will thereby become impaired does not appear to be definitely known, neither is the effect of re-peated freezing and thawing very clearly pointed out. In our winters it frequently happens that water freezes in the shade, while at the same time ice melts in the sunlight, and hence under such circumstances in a wall facing south a slow-setting mortar in the face will be alternately frozen and thawed, while that in the rear will continue to remain frozen. This condition of the work cannot fail to be prejudicial to its ultimate strength, and cannot fail to be prejudicial to its ultimate strength, and manifestly demands that a strong and quick-setting mortar be used if the laying of masonry be continued in freezing weather. Numerous instances of failure of walk and abutments built in the winter might be cited, which are fairly attributable to the thawing out of the frozen mortar after the warm weather had set in, whereby it becomes almost as soft as when first mixed. In such cases the thawed mortar acts rather as a lubricant than as an efficient binding material, and if the structure is then subjected to lateral forces of considerable magnitude, deformation or failure is sure to follow unless a very wide formation or failure is sure to follow unless a very wide margin of safety has been allowed in the design. When, however, the dimensions are fixed with reference to economy and the use of ordinarily good materials and workmanship, as generally happens, the action of frost becomes a very serious factor in the stability and durability of the work, and therefore care should be taken in the proper selection of the cement. It must always be remembered that frozen cement mortar will not set so long as it remains frozen, and that when it becomes thawed it is simply in the condition of material freshly mixed, which, while in that state, imparts no more strength to the structure than

A rather close observation for a number of years of the effects of frost on Buffalo and Akron cement mortars, mixed in the proportion of 2 sand 1 cement and 3 sand to I cement, leads to the conclusion that such mortars enirrely disintegrate to a depth of several inches in exposed joints of masonry laid in cold weather; also, that when used as coatings or renderings of rough stone surfaces a flaking thereof occurs by frost which leads to rapid disintegration. If it is imperative that masonry be built in free-ing weather, a quick-setting Portland cement mortar should be used, instead of such as is prepared with natural cements; also, that even when Portland cement is used with brine, work should be suspended when the temperature is lower than 25° Fah. it good results are to be expected, and, finally, smaller proportions of sand should be used than during the prevalence of higher tempera-

Table No. 4.—Showing Effect of Size of Grain of Sandon Tensile Strength of Cement Mortar.

		Ten	sile stren mixed 3	gth of N	lortar
Denomination of Size of Grains.	Remaining on Sieve of Num- ber of Meshes per sq. inch.		st Sand ter	Crushee	d Granite
		7 days.	a8 days.	7 days	28 days.
Hulled barley Oatmeal Standard Grass seed Grit Coarse dust Fine dust	160 387 774 1290 5807 32258 {	177 162 131 134 141 64	213 191 177 164 160 87	194 176 164 144 136 87	255 234 242 192 193 134

REPORT ON CEMENT AND MORTAR TESTS MADE BY MESSRS. MARX AND MOSSCROP FOR THE EXECUTIVE BOARD OF ROCHESTER, N. Y.

ITHACA, N. Y., June 26, 1887.

E. KUICHLING, ESQ., Member Executive Board of the City of Rochester :

SIR: I have the honor of transmitting to you the results of the tests upon cements and sands furnished by you, and made in the cement-testing laboratory of this department of the Cornell University, by Professor Marx and Instructor Mosscrop. This report is forwarded to you for the use of the Executive Board of the City of Rochester.

Very respectfully,

Dean, Department of Civil Engineering, C. U.



^{*}This is the third of the series on the plant used at the Forth Bridge prepared by E. W. Moir for the Engineering and Building Record.

CEMENT TESTING LABORATORY DEPARTMENT OF CIVIL ENGINEERING, CORNELL UNIVERSITY, ITHACA, N. Y., June 25, 1887.

Prof. E. R. Fuertes, Dean, Department Civil Engineering, Cornell University:

SIR: The undersigned have the honor to submit the following report on two cements and five sands sent to this laboratory by Mr. E. Kuichling, member Executive Board, City of Rochester, for the purpose of determining the relative values of these cements for constructive pur-

poses.

There were received by us five sands, which we designated "P." "R. I.," "R. II.," "R. III.," "R. IV.," and two cements, one "Akron" brand, of which Messrs. McConnell & Jones are the agents, and one "Buffalo" brand, of which Messrs. Whitmore, Rauber & Vicinus are the agents. Each sand and cement was sifted in the nest of standard sieves, of which sizes are given in Table I., and gave the following results as shown in Tables II. and III., No. I being the residue left on sieve No. I, and No. 6 being the material which passed through all the sieves.

A microscopic and chemical analysis was made of each

At the outset it is evident that two things are to be determined—namely, which is the better cement, and also which is the best sand as used with these cements.

COMPARISON OF CEMENTS.

Adopting the volumes, three (3) of sand to one (1) of Adopting the volumes, three (3) of sand to one (1) of cement as of the most common occurrence in daily practice, tests were made with each cement and each of the sands designated "P" and Standard quartz, and also tests of the neat cements for periods of time equal to three days, one week, two weeks and one month, with results as given in Table IV. The standard quartz sand herein mentioned is simply a pure crushed quartz rock, of a fineness sufficient to pass through sieve No. I and be caught on sieve No. 2, and is the nearest approach to a standard sand to be used in the comparison of various cements, that can be obtained. It may be remarked that both of the cements be obtained. It may be remarked that both of the cements stood the prescribed tests for blowing.

These results need no discussion, showing for themselves that the Buffalo brand is the better cement.

COMPARISON OF SANDS.

Now, with reference to the sands, using the same volumes as before, three (3) sand to one (1) cement and the same periods of time over which the tests were extended, tests were made with each cement and each of the five sands, with results as shown in Table V.; and from this and the following investigations we name the sands in the following order as regards merit: R. I., P., R. IV., R. III., R. II.; R. I. being the best, and R. II. the poorest. EFFECT OF FINE PARTICLES IN SAND ON THE VALUE OF

EFFECT OF FINE PARTICLES IN SAND ON THE VALUE OF
THE LATTER FOR USE IN MORTARS.

Beyond the above, which covers Mr. Kuichling's request proper, we beg leave to submit the following, which is by far the most important part of this report, and which we believe to be of general importance to all constructing engineers, rather than of local importance, as it will enable them to judge of the quality of a sand fairly, and on its merits, without waiting a considerable length of time while tests are being made in some laboratory.

The ordinary specification for masonry, in speaking of sands, requires "a clean, sharp sand." All sands contain more or less of a fine, powdery material resembling dust or loam, and which ordinarily passes as such, but in reality is not generally of that nature. The effect of this material on the quality of the sand for constructive purposes, and how much, if any, can be allowed in a sand without necessitating its rejection for constructive purposes, was the point to which we next turned our attention.

Using sand "P" as giving good results and being the one most accessible, we proceeded as follows: From the affeige capalizing the sand in Table II it will be noticed.

one most accessible, we proceeded as follows: From the sifting analysis of this sand in Table II. it will be noticed that the sand is composed of six parts, numbered 1 to 6 inclusive, I being the coarsest and 6 the finest. The sand was sifted and the finest part rejected—that is, we had was sitted and the finest part rejected—that is, we had left a sand composed of parts I to 5 inclusive; also more of the sand was sifted and parts 5 and 6 rejected, leaving a sand composed of parts I to 4 inclusive, and so on leaving out each time an additional part, and thus we obtained five new sands composed as follows: P—(6), P—(5 and 6), P—(4, 5 and 6), P—(3, 4, 5 and 6) and P—(2, 3, 4, 5 and 6); the dash — in each case denoting minus, or subtraction

and 6); the dash — in each case denoting minus, or subtraction.

With these five sands and adopting the same per cent. of sand, cement and water as were used in the original "P" tests with Buffalo cement, tests were made with that cement and extending over three days, one week, two weeks and one month, with results as shown in Table VI.

Evidently from this table the taking out of the fine parts

Evidently from this table the taking out of the hne parts does not improve the sand, but we should ordinarily look then for a continued deterioration, if this holds true, whereas for the sand P—(3, 4, 5 and 6) a sudden increase in strength takes place; the explanation of this is as follows: Having given a sand and cement which are to be mixed into mortar for use, we then know that the best mortar will be the one in which all the particles of sand are coated with cement, and all the voids in the sand are filled with the same material; also, that in proportion as voids are left unfilled in the mortar, the compound deteriorates in strength; and further, that the proper amount orates in strength; and further, that the proper amount of water to be used, is the amount which reduces the cement alone to a workable mass, and that any excess of water which it may be necessary to add to reduce the

mortar to a workable condition, owing to the presence of a large per cent. of fine particles in the sand, will detract from the strength of the mortar on short-time tests. Determinations were made of the number of voids in

1,000 cubic centimetres (c. cms.) of each of these sands and the results are given in Table VII.

Now, since in all these tests, the same weights of sand, cement and water were used in mixing the different batches,

cement and water were used in mixing the different batches, then on the above-stated grounds, the only cause for variation in strength must lie in the fact that in one case there are more voids to fill than in another. Now, on inspection of column 7, Table VII., we find that taking out part 6 increases the voids, and that subtracting 5 and 6 has the same effect, the voids in a given volume being thereby increased; the same result is also obtained on taking out 4, 5, and 6; and from Table VI., we note a continued deterioration in strength. By taking out 3, 4, 5, and 6, the voids diminish to a trifle less than the voids in (P—6), wherefore the strength should increase to above the strength wherefore the strength should increase to above the strength of this last named sand, which we find in Table VI, to be of this last named sand, which we find in Table VI, to be the case. For the last or coarsest sand in said table, the voids are the greatest so far obtained, and the strength then should be the smallest; and on comparison we find such to be the case. From the results in Tables II., VI. and VII., just discussed, we feel justified in saying that the presence of 20 per cent. of silicious material, in a sand so fine that it will pass through seive No. 5, is not sufficient ground for rejecting such sand offered for use in constructive purposes. From Table VI, it is evident that a certain amount of this fine material, depending upon the mechanical composition of the sand, may even be benemechanical composition of the sand, may even be beneficial, since these fine particles fill voids and thus reduce the quantity of cement, which is used for filling voids alone, and allowing it to act in other places as a cementing or covering material for the particles of sand.

Pursuing this question of fine material still further with reference to the sands P., R. I., R. II., R. III. and R. IV.,

we give in Table VIII. the per cent. of siftings 5 and 6 in each sand, and also the proportions by weight that were used in mixing. We can then notice how the sands arrange themselves with reference to fineness, the coarsest being R. I., then in succession P., R. IV., R. III., and R. II, the latter being the finest—which is the same order in which they were previously arranged with reference der in which they were previously arranged with reference to strength; also, that on the basis of the amount of water used, they will arrange themselves in the same order, showing that the cement remaining the same, and the sand changing, the amount of water will change according to the relative amount of fine material in the sands, giving us then a sifting analysis as a simple and sound basis on which to judge the relative merits of sand.

which to judge the relative merits of sand.

In order to see whether the question of voids alone in sands of widely varying mechanical composition was a safe criterion for judgment with reference to their constructive value, we took each one of the five sands—P., R. I., R. III., R. III., R. IV.—and determined the voids in 1,000 c. cms., the results being given in Table IX.

From column 5 it is evident that we cannot consider this point alone, but, as previously shown, we must bring into the discussion the amount of fine material present and the consequent excess of water, over and above the amount necessary to reduce the cement to a workable condition. Proceeding on this basis we get Table No. X., and by taking columns 3 and 4 together, we can form our estimate and reach the same results as before. It must, however, be borne in mind that the above figures refer to a special case in which the that the above figures refer to a special case in which the proportions are by volume three (3) of sand to one (1) of cement, and would change for other proportions of sand

In general we would conclude that the larger the amount of fine material present in a sand, the poorer the sand for

constructive purposes.

That a proportion up to 20 per cent. of silicious material, so fine as to pass through sieve No. 5, may, for economical reasons, be allowed in a sand without any

That a certain amount of this fine material, depending upon the mechanical composition of the sand, may even be beneficial.

With this we must close our report; the subject is interwith this we must close our report, the subject is inter-esting and one which will produce beneficial results on further study. Other points that we had hoped to take up we have been obliged to postpone for lack of time. The question of the effect of frost on cement mortars was touched upon and results were obtained which were sur-prising, and which led us to postpone further investigation until a more favorable time.

> Yours very respectfully, CHARLES D. MARX, Asst. Prof. Civil Eng. Dept. ALFRED M. MOSSCROP, Instructor Civil Eng. Dept.

Table No. 1., Showing Character of Sieves for Sifting Sands.

No. of Sieve.	No. of Holes per Lineal Inch.	No. of Holes per Square Inch.	Size of Hole or length of side in Inches.	Diameter of Wire in Inches.
1	20	400	10150.	.01899
2	30	900	.02179	.01214
a	50	2500	.01119	. 00881
4	Вo	6400	.00500	.006=1
5	170	289∞	.00700	.00279

Table No. II., Showing Analysis of Sands According to size of Grain.

Name	Residue in per cent, of Weight on each Sieve.							
of Sand.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Total.	
			l			i		
P	17%	21%	36%	15%	4%	7%	100%	
R. I	69	15	13	2	i	ó	100	
R. 11	8	3	16	25	3	45	100	
R. 111.	26	5	16	20	2	31	100	
R. IV.	28	19	25	16	τ	11	100	
	<u> </u>	·			<u> </u>	<u> </u>		

Table No. III., Showing Fineness of Grinding of the Cements.

Name	R	Residue in	per cen	t. of Wei	ght on e	ach Sieve	·.
Cem'nt	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Total.
Buffalo	0%	3%	11%	10% 10	1%	75%	100%
Akron.	0	5	18	10	5	62	10:

Table No. IV., Showing Cohesion of Neat Cements and Mortars.

CEMBNT.	SAND.	Tensile Strength in pounds per Square Inch after						
one part.	3 parts.	3 Days.	1 Week.	2 Weeks.	1 Month			
Buffalo	Quartz	16	25	31	51			
Akron	Quartz	11	11	16	32			
Buffalo	" P."	9	17	26	30			
Akron	" P."	7	12	18	23			
Buffalo	Neat	133	127	145	173			
Akron	Neat	113	011	125	149			

Table No. V., Showing Cohesion of Mortars made with the Different Cements and Sands.

Cement,	SAND,	Tensile Strength in pounds per Square Inch after						
one part.	3 parts.	3 Days.	1 Week.	2 Weeks.	ı Month			
Buffalo	P R. II R. III R. IV	9 13 0 4	17 20 8 14 10	26 28 13 21 18	30 42 24 33 35			
Akron	P R. I. R. II R. III R. IV	7 4 0 0 0	9 9 4 3	18 14 14 15 13	23 20 23 20 28			

Table No. VI., Showing Effect of Removing Fine Particles from Sand on the Cohesion of Mortars.

		Tensile st	rength in t	bs. per sq.	in. after
CEMENT, one part.	SAND, three parts.	Three days.	One week.	Two weeks.	One month.
Buffalo.	P.—(6) P.—(5 & 6) P.—(3, 4, 5, & 6) P.—(2, 3, 4, 5, & 6) F.—(2, 3, 4, 5, & 6)	0 4 2 2 3	17 8 9 4 8	26 11 11 13 16	30 22 20 14 24 18 ?

Table No. VII., Showing Amount of Voids in Sands of Different Fineness of Grain.

SAND.	Weight in Gr'ms.	Loose Vol. in C. Cms.	Compacted Vol. in C. Cins.	Voids in C. Cms.	Solids in C. Cms.		of 1000 Grms in. C. Cms.	Loose Equiv. of 1000 Grms in C. Cm s.
P 6 P 6 P (5 & 6) P - (4, 5, & 6) P - (3, 4, 5, & 6) P (2, 3, 4, 1) 5, & 6)	1840 1653 1602 1508 1508	1000 1000 1000 1000 1000	988 976 913 895 908 1000	277 286 283 290 263 346	711 690 650 605 645 654	150.5 173.1 176.7 185.0 167.8	417.5 393.3 385.9 411.4	605.0 624.4 627.9 637.9

Table No. VIII., Showing Percentage of finest Matter in the several Sands; also Proportions by Weight used in Mixing Mortars.

١		Per cent. of	Weight in Grammes used in Mixi				
CEMENT	SAND.	(5+6 in the sand.	Sand.	Cement.	Water		
D. 0.1.							
Buffalo.		11	1000	313	205		
	R. I.	1	1000	250	150		
	R. II.	48	1000	313	253		
	R. III.	33	1000	310	250		
	R. IV.	12	1000	273	208		
Akron.	P.	11	1000	313	205		
	R. I.	1 1	1000	195	146		
	R. II.	48	1000	244	244		
	R. 111.	34	1000	239	239		
	R. IV.	12	1000	208	208		

Table No. IX., Showing the Amount of Voids in the Several Sands and Cements.

SAND OR CE- MENT.	Weight in Grms.	Loose Vol. 10 C. Cms.	Compacted Vol. in C. Cms.	Voids in C. Cms.	Sol'ds in C. Cms.	Compact Equiv. of 1000 Grms. in C. Cms.
P	1840 1670 1661 1661 1760 1097 1001	1000 1000 1000 1000	988 907 845 888 897 717 722	277 265 277 259 257 402	711 642 618 629 640 315 282	150.5 386.5 543.5 158.7 384.5 598.9 156.7 377.0 601.9 155.9 378.6 601.9 145.5 362.4 566.2 366.4 287.1 911.5 439.7 281.8 999.3

Table No. X., Showing Excess of Water Required to Fill Voids.

CEMENT.	Sand.	Voids Filled by	Excess of Water over Voids in Dry Mixture Sand 3; Cement 1; in C Cms.
Buffalo	P.	59.7	144.4
	R. I.	46.3	64.8
	R. II.	53.4	176.2
	R. III.	57.1	183.1
Akron	R. IV.	53.9	140.9
	P.	58.6	142.7
	R. I.	34.6	42.3
	R. II.	41.3	146.1
}	R. III.	43.2	150.5
	R. IV.	40 3	121.1

NEW YORK AND BROOKLYN BRIDGE.

REPORT OF COMMITTEE ON TERMINAL FACILITIES. To the Board of Trustees of the New York and Brooklyn

Bridge.

Gentlemen: The undersigned, on the 23d of February, received from the Board of Experts their report on the enlargement of traffic facilities at the New York terminus of the bridge. This report, which you have received, is a very careful and exhaustive one, worthy of the reputation of its authors, and one which clears the way toward arriving at definite conclusions.

The Board of Experts were not asked to estimate the cost of the improvements recommended by them, and immediately upon receiving their report the Chief-Engineer, Mr. Martin, was instructed to make careful estimates of the cost of lands, buildings, new machinery and cars necessary to apply the circulating system as designed by A. M. Wellington, C. E., to both termini of the bridge. His report, just received, gives the cost as follows:

COST OF THE WELLINGTON CIRCULATING SYSTEM FOR EIGHTEEN-CAR TRAINS.

Description.	New York Terminus.	Brooklyn Terminus.	Total.
Real Estate for Stations Real Estate for Store Yards	\$1,797,750	\$456,500 448,000	\$2,254.250 448.000
Station Buildings	1,100,000	1,155,000	2,200,000
New Plant and Machinery			475,000
100 New Cars	• • • • • • • •		400,000
Total			\$5,777,250

This is a very large sum, and one which it might be se to expend, so far as it would go, in providing new bridges or tunnels rather than to expend it upon the pres-

ent bridge.

The attention of your committee and that of the Chief Engineer was then directed to see how the present system can be enlarged. The Board of Experts in their report (p. 10) say: "The maximum capacity of the bridge rail-(p. 10) say: "The maximum capacity of the bridge fairway can only be attained by increasing the number of cars per train to the limit most desirable in actual service (which experience in operating them alone can demonstrate), and in fixing the headway intervals as short as absolute safety requires for handling trains of increasing lengths." This is very sound advice, and acting upon it,

investigations have been made, which show that it is iminvestigations have been made, which show that it is impracticable to run eighteen-car trains as proposed by Mr. Wellington. The Chief Engineer considers, and your committee agree with him, that four-car trains are about as long as can be safely and quickly handled.

This does not affect the adoption of the circulating system at all, for that is merely a method of avoiding switches and an adaptation to limited space. The space in Brooklyn is not limited, and there is no reason why the present rectangular system with tail switching modified

present rectangular system with tail switching, modified as suggested by the Chief Engineer, will not answer every purpose for the Brooklyn terminus for some years to come.

purpose for the Brooklyn terminus for some years to come.

The same system can also be applied to the New York terminus, and no encroachment beyond the present lines of tracks upon Centre Street, and no new lands will be needed. This modification of the present system is merely to add two more tracks parallel to the present ones, with intermediate platforms, all as shown in accompanying drawings, marked:

A. proposed New York terminus.

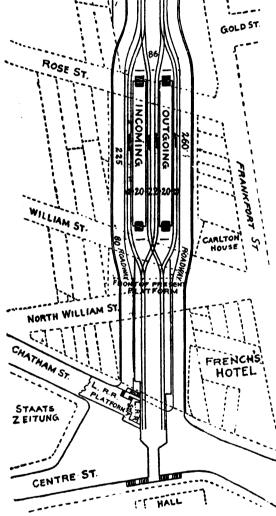
B. proposed Brooklyn terminus.

B, proposed Brooklyn terminus.

A double set of rails will be required on each track, to avoid the use of switches for incoming trains, and leave the tracks unbroken. Under the present system the capacity of the Bridge Railway is limited by the time required to stop trains, unload them, switch them into place and reload them, which is *eighty seconds*.

But if two trains can be loaded and unloaded simulta-

neously, they can be dispatched in half the time now required, say forty seconds, thus doubling the present capacity of the road.



The following table will show the increase:

•	between conds.	of cars	f trains	of cars		ngers d per ur.
Systems.	Intervals 1 trains. Se	Number o	Number o	Number of per ho	Seated, 42 in car.	Seated and standing,
As now operated with 3-car trains As now operated with 4-car trains	80 80	3	45 45	135 180	7,500	17,010
Proposed plan, 4 tracks and 4 cars	40	4	90	360	15,120	45,360

cost of this improved system is estimated by the Chief Engineer, as follows:
RECTANGULAR SYSTEM, FOUR TRACKS.

	N.Y. Station.	Brook- lyn.	Total.
Real estate for stations	None.	None.	None.
Station buildings	\$140,000	\$120,000	200,000
Seventy-five new cars			300,000
New plant and machinery	•••••	· • · • • • • •	40,000
Total			\$773,000

Your committee have no doubt that this improved rect. angular system is the one to be first carried out, and used until the traffic outgrows it.

There is nothing new or experimental about it. Its safety has been tested by over four years' experience and the conveyance of ninety million passengers, in more than 700,000 trains without accident to life or limb with the exception of the loss of a foot by a passenger in Decem-

ber, 1885.

It requires only slight alterations of the present machinery, and the alterations to the tracks, platforms and buildings can be carried out gradually and paid for out of These changes. the earnings of the bridge, as in the past. These changes will not interfere in the least with the traffic upon the

bridge.

The safety appliances recommended by the Board of Experts can be equally well applied to this system as to the circulating system, should it be decided that they are needed.

second set of overhead tracks, to carry So also a trains of the Brooklyn elevated railways, can be applied to one system as well as another if they are wanted.

It now only remains to consider what shall be done in

the future, when this system is outgrown

The number of passengers carried in 1887, by three-car

The number of passengers carried in 1887, by three-car trains in eighty seconds apart, was 27,940 000. With the same average number of passengers per car the yearly number that can be carried will be about 75,000,000.

According to the estimate of the Board of Experts this number will not be reached until 1895, or seven years from now. Up to that time this proposed system will answer with an expenditure of \$773,000.

It seems to your committee that it would be a more prudent and conservative course to put this system in open

dent and conservative course to put this system in opera-tion and postpone the large expenditure until the traffic demands it.

In this age of inventions there is no knowing what the next seven years may produce, and if the Bridge Trustes are not hampered by a present expenditure of nearly six million dollars, they will be ready for the best thing that

offers.

We now recommend that the President and Chief-Engi

First-

-To put four-car trains in operation on the present system.

Second—To prepare for the doubling of this system as above described and shown in plans A and B, and put it in operation as soon as the needs of the traffic shall de-

mand it.

And your Terminal Committee now ask to be discharged.

All of which is respectfully submitted,

T. C. CLARKE, C. E., JAMES HOWELL, President, Committee.

BROOKLYN, April 17, 1888.

THE PROPOSED SEWERAGE OF WICHITA KANSAS.

MESSRS. ROSEWATER & CHRISTIE, Civil and Sanitary Engineers, of Omaha, Neb., have submitted plans and estimates for the sewerage of Wichita, Kansas.

The position of the city embraced by the scheme extends along the Arkansas River about four miles, and is about one and a half miles wide. It is a slightly undulating plain, with surface slopes so light as to give less than four feet to the mile, even in the most favorable portions of the city. The high-water level of the Arkansas River is less than three feet below the level of the lower sections of the city and about six feet below the business centre.

There is, however, a large bend in the river just below the city, in which the fall is so great that it is possible to keep an intercepting main ten feet below the surface and with a grade of four feet to the mile still discharge above the high-water level of the river at the bend.

As the natural surface drainage of the city was reasonably good, and the cost of a combined system was estimated at about \$1,500,000 as against \$365.374 for a separate system, the latter was recommended, of which the following are the leading features:

Laterals to be of eight-inch salt-glazed vitrified pipe, with grade of 400 and provided with 250-gallon flushtanks, to be ventilated through perforated manhole covers every 400 feet, and by soil-pipes extending above the house-roofs.

Mains to be from fifteen inches to three feet in diameter, Mains to be from fifteen inches to three feet in diameter, to be built of bricks in Portland cement, when over two feet grade to be Tro; they will be low enough through the city to be flushed from the river and will have self-flushing gates as well. The total length of sewers is estimated at 84.7 miles, divided into mains, 5 miles; submains, 13½ miles; laterals 66.2 miles.

It is suggested that the mains and sub-mains be built at the expense of the city in which case the assessment for

at the expense of the city, in which case the assessment for the laterals alone would be 33 cents per foot front of abutting lots. If the whole cost is assessed on abutting

abutting lots. If the whole cost is assessed on abutting lots it will be 62 cents per foot front.

Mr. H. S. Maddock, a civil engineer of Chicago, has also estimated on a combined system for part of the city, and one of his plans contemplates pumping the sewage.





THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. XV.

(Continued from page 604, Vol. XV.)

WE are indebted to Mr. Edward Murphy for the copy here presented of the questions and answers prepared by him for the plumbing class at the New York Trade School. This subject forms the eighth topic in the series of which we have presented the seven preceding ones in Vol. XV.

HOUSE PUMPS.

1. Explain the principles on which the action of a pump depends and enables it to lift water?

When a vacuum is formed in the suction-pipe of a pump the pressure of the external air forces the water to rise into the pump, provided the lift is not too great.

2. What is the greatest perpendicular distance that a pump can lift water from?

Theoretically, water should rise about 33 feet. Practically, pumps draw only from 23 to 28 feet.

3. Does it make any difference in the working of a pump whether the water is at a greater or less distance from pump?

It does, as the nearer the pump is to the water the more easily water can be raised.

4. Describe some of the pumps used for ordinary purposes.

The suction, the force and lift, and the double-action or ship pump. There are many others.

5. Have double-action pumps any advantages over singleaction, and why?

They have, because they keep up a steady stream and labor is economized, as every stroke up or down is effective. In the single-action pump, the down stroke only does the work.

6. Describe the different parts of a pump and explain the action of the valves.

The barrel or cylinder, the piston, the valve at bottom, the fulcrum, the brake or handle, top and bottom caps, couplings and packing boxes or glands.

7. In a badly working pump where should the trouble be first looked for, and how should it be remedied?

For leakages in the pipes or couplings; next in the valves. Pipes should be made air-tight and valves put in proper condition.

8. What difficulty is experienced in pumping hot water or volatile fluids?

The vapor prevents a vacuum being formed. In that case the pump must be very close to the fluid.

9. What advantage is gained by using large pipes for suction and rising pipes?

Friction is lessened, therefore more water can be obtained and the labor is diminished. There is no danger of making pipes too large.

10. What is the object and advantage of using air and vacuum chambers on pumps?

As they contain large quantities of air which is compressible the pump is assisted by its alternate compression and expansion.

II. What m-terials are used in the construction of pumps, and which appears to be best adapted for the purpose?

Brass, copper, and iron, sometimes glass. Brass would seem the best.

12. In pumping from wells what precaution should be taken with ends of suction-pipes?

They should be covered with a basket of fine wire gauze or by perforated metal cap.

13. In supplying large house-tanks what other means besides hand labor are employed?

Steam, hot air, and gas.

14. What is a driven well? An artesian well?

A driven well is one where the pipe is driven into the ground by a maul until water is found. An artesian well is one where the hole is drilled a great distance through the ground or rock, and then piped down to the water.

15. What is a submerged pump and where is it used?

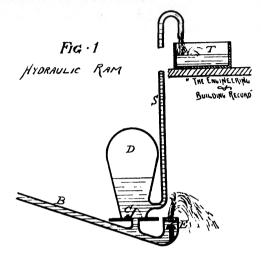
A submerged pump is one placed entirely under water, which it forces to the required point. It is chiefly used where the water is foul or gritty, as in cellars and sewers and for tanneries, etc.

16. When water happens to be 75 or 100 feet or more below the level of ground, how can it be raised if a pump will not draw over 30 feet?

The pump must be set within drawing distance of the water and forced the rest of the way.

17. Explain the principle and working of the hydraulic ram and wherein it differs from a pump?

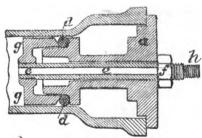
The hydraulic ram is a contrivance for raising a small quantity of water to a considerable height by utilizing the momentum of a larger quantity of water flowing downwards. It differs from a pump in that it neither has a piston nor produces a vacuum, and that it must always be placed below the source of supply.



In Fig. 1 the water is received through the inclined pipe B, the momentum of its discharge raises and closes wastevalve E, when the pressure opens valve C and forces water into air-chamber D until the pressure is relieved and C closes and E opens, when the water again commences to come down B, and the operation goes on continually. The air in D is compressed by the entrance of the water into the chamber and forces it up the pipe S as soon as the valve C is closed.

PLUG FOR TESTING PIPES.

THIS device, invented by Jacob Jooss, is described in the Revue Industrielle, from which the illustration is taken. Its principle is the same as that of several that we have recently described-namely, the lateral expansion of an elastic ring produced by compressing it in a direction parallel to the axis of the pipe. Its use is very simple. A plug having been introduced into each end of the pipe to be tested, the nut f of each plug is screwed up, drawing together the head a and the follower g by the rod e, and compressing between them the India-rubber ring d, which is thus forced out against the inside of the pipe until sufficient tightness is secured.



PLUG FOR TESTING PIPES

One of the plugs has the rod e hollow with a thread at h, to which a proving pump can be connected.

The head a, it will be noticed, is adapted to fit either the bell or spigot end of the pipe, and the portion of the follower g which bears against the ring d is inclined so that the tendency of the proving pressure to force the plug out serves to wedge the packing ring more tightly against the inside of the pipe.

NATIONAL ASSOCIATION OF MASTER PLUMB-ERS OF THE UNITED STATES.

THE Essay Committee of the National Association announce the following subjects for consideration at the forthcoming convention. Each of the constituent associa.

tions are requested to state which of the subjects they pro pose to discuss:

- 1. The Qualifications for Conducting the Plumbing Business:
 Does the plumber have the same confidence reposed in him as the family physician; if not, why not?

 2. How to Promote the Unity of the Associations: What benefits are derived from the National Association? Upon what does the security of the local and national association depend?

 3. The Disposal of Drainage in Inland Cities: Can it be made a source of profit as a commercial enterprise?

- 4 The Holly Water System: Is it advantageous for inland cities?
- 5. The Artesian Well as a Source of Water Supply: Under wha ircumstances is it to be preferred to other means? How most ecomically can the water be conducted to be used in our houses?

 6. Is the public benefited by competition in the p'umbing trade?
- Salt-glazed Sewer Pipe versus Cast-iron Pipe for Interior
- 8. Lead Pipe versus Galvanized Iron Pipe: Has the former any advantage as waste-pipes over the latter? Can the latter be protected from corrosion?
- 9. Indirect versus Direct Supply to Water-Closets and Ur nals.
- ro. The Lighting of a Country Residence: Material to be used. If gas, how obtained, or manufactured?
- 11. Surface-Water Drainage: Should it be separate from the sewerage system in cities? Importance of surface-drainage in small towns and country places.

 12. Best Material to be used for Ventilating Pipes Connected with Plumbing Fixtures: Iron, lead, galvanized iron, etc. Method of making joints. Where should ventilating-pipes be discharged?

- making joints. Where should ventilating-pipes be discharged?

 13. The Drainage of a Country Residence: System of disposal where there is no sewerage. Extent of prumbing in such a house.

 14. American Earthenware versus Imported Ware: Is there any difference as to quality? Is there any prospect that the tormer will some time be used exclusively in this country?

 15. Hot Water as a Means of Warming and Ventilating Buildings: As compared with the use of Steam. How far does the plumber's work extend in fitting up such a system?

 16. How to Prevent Waste of Water in Cities: Methods of Inspection. The use of Meters. Kind and character of house fixtures.

 17. The Out-door Water-Closet in Coid Climates: Method of construction. Advantages over a common privy.

 18. Disposal of Garbage: Of a city or village. Of individual house refuse burning in stoves. Garbage-burners.

 19. The Rise and Fall of the Lead Worker in the Plumbing Trade.

 20. The History of the Pump.
- - The History of the Pump.
- 21. Electricity in the Plumbing Trade: Applications. Dangers to workmen from electric wires.
- 22. The Automatic Flushing Apparatus.
- 23 The Plumber as an Inventor: Make application to sanitary goods and appliances. Comparative value of the plumbers' invention in this line over those of the manufacturer, dealer or "specialist."
- 24. Natatoriums or Public Baths: Their construction. Benefits to be derived as a Sanitary measure.
- 25. The Air Currents of the Interior of Bui'dings: How effected by changes of temperature and prevailing winds. Are the seals of traps of plumbing fixtures affected by them?
- 26. The Plumbing Fraternity-Past, Present and Future.
- 27. The Proper Training of Apprentices.
- 28. The Habitations of the Poor: What is the condition of the plumbing and drainage? Cite instances of profitable and healthful habitations for the poor.
- 29. Is it Desirable to Establish a Home for the Aged or Infirm Plumbers? Should it be a State or national institution? How formed and supported?
- 30. On the Expediency of Establishing a National Trade School: How should it be organized and supported?

 31. The Inspection of Plumbing and House Drainage: Should the inspector be governed by the Board of Health or by a board of plumbing and house-drainage commissioners? How often should such inspections be? In what manner should the work be tested?

PHILADELPHIA MASTER PLUMBERS' ASSO. CIATION.

(Special Correspondence.)

AFTER considerable discussion over the recommendation of a special committee regarding tests of house drain-pipes, previously published in these columns, the following resolutions were adopted:
"That we recommend to

ing resolutions were adopted:

"That we recommend to the Board of Health for adoption as the proper test, that a pressure equal to three pounds to the square inch be applied to the soil-pipes or drainage system in new houses or to entire new work in old houses before the fixtures are attached or placed in position.

"Resolved, That for all work with the fixtures attached or in position that a pressure equal to one inch water-gauge shall be the proper test."

The resolutions were forwarded to the Board of Health,

and at their meeting on April 17, after tacking on a resolution that a fee should be charged for each such test, the subject was referred to a committee.

THE Chicago Master Plumbers' Association enjoyed their annual ball April 12 at the First Cavalry Armory. Handsome gold badges went to the retiring officers. The Arrangement Committee was A. W. Murray, T. C. Boyd, and ex-Alderman Ryan.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas Light Company.
April 14	25.40	20.31	22.74	30.30	29 03	25.33	32, 50
DIÓ	gitize	ed b	y -			XI	

HOT-WATER BOILERS AND FLOW-PIPES IN THE HOUSE OF NOTRE DAME,
TORONTO, ONTARIO

A CORRESPONDENT, while investigating the methods of warming buildings by hot water in Canada some time since, sent us the following sketches, etc., of the boilers and flow-pipes of the heating apparatus in the House of Notre Dame, Toronto.

He writes: The extraordinary small space occupied by the boilers in this building compared to the space required for steam-boilers for the same sized building surprised me. The actual floor-space of the two boilers was only 7 feet 3 inches by 4 feet. This, of course, did not include the fire-room and the space taken up by the connections. The latter, however, take immensely more room than the boiler, all of which, though, would occupy much less space than any steam-boilers could that would be suitable for such a building. I was unable to find the amount of heating surface in the building on account of the difficulty of going through the rooms etc., but I was enabled to make sketches and measurements of the boilers and the pipes, which you will see in Figs. I and 2.

As all the valves on the flow-pipes are tagged and numbered, and the rooms they control marked on them, I by this means approximated the surface as given below. Circuit 9.—Size, 2 inches; room A and parlor; 200 square feet.

Circuit 10.—Size, 2½ inches; reception-room and two vestibules; 300 to 400 square feet.

Circuit 11.—Size, 3 inches; top floor and new hall; 400 or 500 square feet.

Circuit 12.—Size, 2 inches; rooms 29, 30, 31, and corridor; 150 square feet.

Circuit 13.—Size, 2 inches; rooms 6, 7, and 8; 150 square feet.

Circuit 14.—Size, 2½ inches; corridor 1 and room D; 200 square feet.

Circuit 15.—Size, 1½ inches; corridor 2 and room 14; wall coil, 120 square feet.

Circuit 16.--Size, 11/2 inches; top floor; wall coil, 100 square feet.

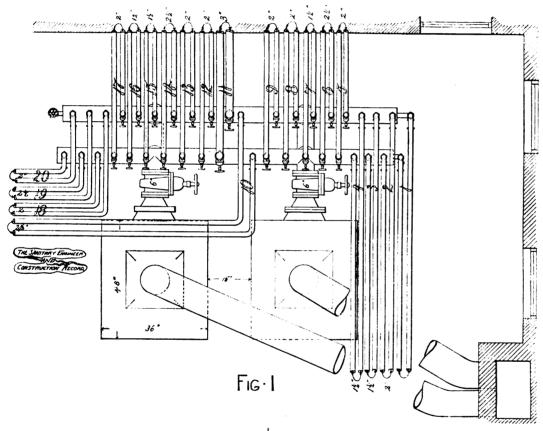
Circuit 17.—Size, 2 inches; back hall and office; 150 square feet.

Circuit 18.—Size, 2 inches; north wing, library and reading-room; 150 to 200 square feet.

Circuit 19.—Size, 2½ inches; north wing, first floor; 300 to 400 square feet.

Circuit 20.—Size, 2 inches; corridor, north wing, closets, etc.; 150 square feet.

The total surface in this building cannot be much short of 3,700 square feet, and a room 12x12 feet is certainly



It will be noticed a six-inch valve controls the main flow and return pipe of each boiler. To each valve is joined a header or manifold, and from these manifolds the flow and return pipe for each subdivision of the house is taken in pipes ranging from 3 inches to 1½ inches in diameter, as will be seen by reference to Fig. 1. Each couple or circuit is numbered from 1 to 20 inclusive, and the size of the pipes with the rooms of the building they supply and an approximate estimate of the surface made by one who is accustomed to heating apparatus is given in the following list:

Circuit No. 1.—Size, 2½ inches; room supplied are, chapel, practice-room and bath-room; square foot surface probably not under 400 feet.

Circuit No. 2.—Size, 2 inches; large bath-rooms; surface, 150 square feet.

Circuit No. 3.—Size, 1½ inches; bath-room; surface, 75 square feet.

Circuit No. 4.—Size, $1\frac{1}{2}$ inches; two coils in chapel; surface, too square feet.

Circuit No. 5.—Size, 2 inches; coil, south-west corner sitting-room, first floor; 120 square feet.

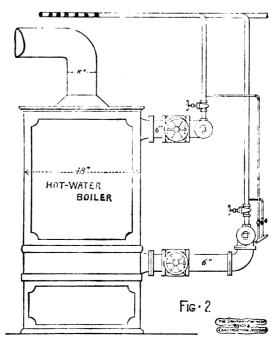
Circuit No. 6.—Sitting-room, second floor, and girls'

dormitory; size, 2½ inches; 250 square feet.

Circuit 7.—Size, 1½ inches; breakfast-room and room

C; 100 square feet.

Circuit 8.—Size, 2 inches; rooms 2 and 4 and water-closet; 150 square feet.



more than ample for the plant, so far as boilers and valves are concerned.

The necessity for so many small pipes or circuits 1 cannot see the philosophy of. Still it is the result of practice here, and men who have tried a large single main instead say they cannot get as good results and are not so sure of what they will obtain as with the system shown here.

The heat from these mains is, as a general thing, not lost. It warms the halls and rooms of the basement and their influence is felt through the whole house, and correspondingly less surface is required in many of the upper parts of the building.

A means of drawing the water from any single circuit is shown in Fig. 2. A pipe of small diameter is joined with the flow and return pipe just above the stop-valve in each case.

The fuel used in this building was given at three tons per week in cold weather.

ENGINEER.

WATER-BACK VERSUS HEATING COIL.

FORT SUPPLY, I. T., April 8, 1888.

SIR: Suppose you want to put up a 40-gallon cylinder boiler close by a range, how will you heat the water in the boiler? Would you have a coil of pipe running from the boiler through the side of the range in contact with the fire and then return into the boiler, or would you have the boiler connected by pipe with a water-back attached to the range? Which is the best method?

The intention is to have a constant supply of hot water on hand for bathing purposes, the hot water to be conveyed by about sixty (60) feet of pipe to the bath-room. Have you ever known an accident to happen from the bursting of a heating coil inside of the range? Please give your views fully on the subject and oblige.

Yours respectfully, WATER-BACK.

[If the range is constructed for a proper size water-back we should use it. If not, we should use the pipe. We do not recall any instance of the bursting of such a pipe, except when circulation was obstructed by frost, then result would be as bad if not worse with water-back. If the water-back is too small to produce the hot water required more available heating surface may be secured by the U-shaped pipe used in its place.]

SIZE OF CHIMNEY FLUE FOR BOILER.

HONESDALE, PA., April 4, 1888.

SIR: We have a house which calls for 300 square feet of direct and 100 square feet of indirect radiating surface.

The boiler used is capable of supplying 650 square feet of direct radiating surface. The chimney flue 8 "x9", and has good draft, but fire in boiler burns very poorly; we claim chimney flue should be at least 12 x12'. Will you please answer through your columns?

Yours, etc., W. W. Woon.

[A chimney flue of half a square foot of cross section is rarely enough for a house-heating boiler even of the smallest

In very cold weather, with the apparatus you describe, the consumption of coal may be reasonably set at twenty pounds per hour. Each pound of fuel will require and liberate gases to the amount of about 600 cubic feet at the temperature which they pass into the chimney, or 12,000 cubic feet in all. To pass this through a flue of 8'x9' or half a square foot will require an effective velocity of 6.6 feet per second over its whole area. This velocity, though easily obtained theoretically in flues of any practical magnitude, is rarely obtained in house-flues on account of the amount of resistance caused by rough brick-work and short or square turns. The leakage of air also through the comparatively thin walls of the flue is considerable, and when boilers have brick setting there is also a considerable infiltration or leakage of air through the walls of the setting. which has to pass off by the chimney flue. An 8'x12' flue might be ample, though if we were building a chimney we would make it 12"x12", if of brick. A 12-inch circular pipe built into the walls we consider equally as good as a 12-inch square when made of brick, as they are usually built.]

CREDIT FOR FIRST USING NESSLERIZED AMMONIA AS A STANDARD FOR COMPARISON OF COLORS OF NATURAL WATERS.

Boston, April 17, 1888.

SIR: The credit of first using Nesslerized ammonia as a standard for comparison of the colors of natural waters belongs to my friend, Prof. A. R. Leeds. I had overlooked this when I wrote my paper on the "Color and Odor of Surface Waters," which you notice in your issue of April 14.

Yours, T. M. Drown.

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COMPRESSIVE STRENGTH OF CEMENT.

IN reply to question in your last issue, experiments on the compressive strength of cement have rarely been made since the easier tests on tensile strength have been held to indicate approximately (?) compressive, transverse, and shearing strength. John Newman, the latest English authority on cement, says: "As the compressive strength of cement is very much greater than its tensile or adhesive strength, unless it be for an exceptional purpose, there is no occasion to ascertain its power of resistance to compression."

there is no occasion to ascertain its power of resistance to compression."

Boehme, Bauschinger, and Mauk, careful German investigators, have found for best, slow-setting, finely-ground Portland cement a compressive strength of 4,540 to 4,200 pounds per English square inch. If cement is to perform an important function as a material of construction, distinct from its duty of filling the joints in heavy masonry, and thereby increasing stability by an increase of friction between the adjoining blocks, nothing but such Por land cement as above should be relied upon. Such car.fully selected material may be used with a smaller coefficient of safety than any natural stone, and hence may be rated as the equivalent of the most valuable building be rated as the equivalent of the most valuable building stones obtainable.

For joints where the cement is not in contact with the atmospheric air the cement may be used neat, since, unlike lime, it does not require sand for mixture, and the admixnme, it does not require sand for mixture, and the admixture of sand rapidly weakens its strength. When mixed with one, two, and three parts of sand its strength is reduced to 71, 51, and 42 per cent. of its strength when used neat, as proved by J. Grant in London, and Doctor Michaelis in Berlin.

WASHINGTON.

ADOLPH CLUSS.

STEEL VERSUS WROUGHT IRON FOR BUILD-ING PURPOSES.

PHŒNIXVILLE, PA., April 18, 1888.

SIR: Referring to the statements of Mr. C. L. Strobel, Mem. Am. Soc. C. E., in your issue for April 14, relative to the weights of steel and tron rolled beams and the economy of weight claimed in favor of steel, it may be of interomy of weight claimed in favor of steel, it may be of interest to note that for three years past iron beams have been rolled at the Phœnix Iron Works as light in weight as the steel beams specified. Fifteen inch iron beams, weighing 41 pounds per foot, and 12-inch iron beams, weighing 32 pounds per foot, are made without difficulty and with most satisfactory results. The experiments of Mr. James Christie, Mem. Am. Soc. C. E., "do not show that steel of any grade is stiffer under working loads than wrought iron"; and his further statement that "beams of either steel or wrought iron having uniform lengths and cross sections will deflect uniformly, under equal loads, below the elastic limit of wrought iron " is fully borne out by the observations of many tests. tions of many tests.
Under these circumstances the superior economy claimed

for steel beams does not appear to be warranted by the for steel beams does not appear to be warranted by the facts, and the editorial comments of your issue of March 17 are as clear and definite a presentation of the comparative merits of the two metals as could be desired.

Very truly yours,

AMORY COFFIN,

Mem. Am. Soc. C. E.

WHO SELLS CLAMOND OR WELSBACK INCANDESCENT GAS BURNERS?

PROVIDENCE, R. I., April 10, 1888.

SIR: Can you tell me whether the incandescent gas-burners, Clamond or Welsback, are for sale in this country, and, if so, where?

C.

[Referred to our readers.]

"E," of Chatham, N. Y., is notified that anonymous communications cannot be answered. Names are always required as evidence of good faith.

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE monthly meeting of the Boston Society of Civil Engineers was held April 18 at the Society's Room, and called to order at 7:30 r. M. by President Fitz Gerald.

Ten new members were elected, and, after transacting current business, Mr. L. Frederick Rice read a paper on "The Methods and Apparatus used in the recent test of Water-Meters at Boston," and showed the apparatus used for weighing and recording the water measured.

A paper was also read by Mr. Weston, of Providence, on "Use and Test of Water-Meters in Providence."

on "Use and Test of Water-Meters in Liousens Forty-two members and fifteen visitors present.

ENGINEERS' CLUB OF KANSAS CITY.

AT the regular meeting April 2 there were thirteen members and eleven visitors present, and the minutes of the previous meeting were read and approved.

A letter from Mr. L. E. Cooley to the Committee on National Public Works was presented by Mr. Chanute, stating that delegates from the various engineering societies would meet in Washington April 9 and 10, and requesting that the Kansas City Club be represented.

The club voted to defray the necessary traveling expenses of a delegate to Washington, the delegate to be selected by the Executive Committee.

Contributions to the discussion of the evening were read from Messrs. C. E. H. Campbell, of Council Bluffs, lowa; C. G. T. Bouscaren, of Cincinnati; George L.

Strobel, of Chicago, and A. J. Tullock, of Leavenworth. The following were elected as members: Charles C. Gilman, Robert Gillham, Charles S. Brown, James H. Grove, E. J. Remillon, Frank Allen: and as associate members, J. B. Hodgdon, George K. Musselman.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

THE regular monthly meeting of this society was held at Pittsburg, April 17th, Vice-President Prof. J. A. Brashear in the chair.

Messrs. Louis B. Fulton and Geo. B. Barbour were elected members.

Mr. P. Barnes, Superintendent of the Steel Department of Jones & Laughlin, made some remarkson "The use of Aluminum Alloy in Steel."

Mr. Barnes said: If this question of the use of aluminum

alloys is to be brought up, what additional requirements as alloys is to be brought up, what additional requirements as to quality are we likely to have pressed upon us? For himself, he did not see that that there was anything further necessary than the methods now employed. He next asked, to what extent have makers of alloys a claim upon steel makers, if the latter decline to experiment with the alloys which are sometimes thrust upon them? He hought that the expense of the experimenting, should be thought that the expense of the experimenting should be borne by the makers of alloys.

Mr. Metcalf stated that the only use he had ever heard

made of aluminum in steel was to make the ingot sound. One of the effects of aluminum is to "quiet" boiling steel

One of the effects of aluminum is to "quiet" boiling steel almost immadiately.

M1. Hunt said that it was claimed for aluminum alloy that added to steel it gave the metal fluidity. He had found the claim sustained, but thought the alloy at \$4.00 per pound cost more than it was worth.

Mr. Hibbard, of the Linden Steel Company, said that after three experiments with an ordinary steel, about 18 carbon, 50 manganese and \(\frac{1}{0} \) per cent. aluminum, they obtained an average tensile strength of 70,000 lbs., and an elongation of 27 per cent.; and without aluminum similar stock gave but 65,000 lbs. ultimate, with but 22 per cent. elongation.

Mr. Brashear stated that some experiments with aluminum alloys for tools and for polished surfaces were very satisfactory.

Mr. Clapp, of the Pittsburg Testing Laboratory, commended the wearing powers of the metal.

Mr. Barnes said that perhaps the presence of silicon might account for the quieting of boiling steel, as well as the aluminum.

Mr. Hibbard stated that in the case he mentioned there

was only about one eighth as much silicon as was usually used for that purpose.

At the May meeting the paper to be presented will be "Fifteen Years of Steel Making," by Mr. Koch, Superintendent of the Spang Steel and Iron Company.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

ARERICAN SOCIETY OF CIVIL ENGINEERS.

A REGULAR meeting of the society was held at their rooms on the 18th inst., Vice-President J. James R. Croes in the chair. The secretary read a paper by Mr. D. V. Purrington, secured by request for information on the manufacture of bricks as practiced by the Purrington-Kimbell Brick Company of Chicago. No originality was claimed for the method employed, and the paper was simply a straightforward description of sensible and successful work, as follows:

A Chambers stiff mud machine, the first of its kind to be used was set up early in 1882, and fed with clay

be used, was set up early in 1882, and fed with clay dredged from the Chicago River. This proved too wet for the machine to work advantageously, though the hard blue clay underlying the city worked very well.

Another machine was soon after purchased and set to work on clay that had been dredged from the Illinois and Michigan Canal 25 years before, of which in 3 years they made 46,000,000 bricks, the yearly maximum being 10,000,000 for a machine with a dryer, and 6.500,000 for

This clay being exhausted, 47 acres were purchased at Purrington, 14 miles from Chicago, and the present works erected in 1886. The clay there is very hard, although slightly granular. At first it was obtained by pick and spade, but eleven men could not mine and load enough in ten hours for 45,000 brick, and dynamite was soon freely used as the bank got harder and dryer. When the clay was very hard a pound of dynamite in a 2-inch hole would only shatter and crack the bank so as to make it easier to

dig.
In the Chicago clay, which was of an India-rubber texture, the dynamite merely made an egg-shaped cavity about as big as a half barrel, around which the clay was very solidly packed without crack or fissure.

In loamy or sandy clay a hole 1 to 8 inches in diameter is made for the charge to the surface.

Dynamite soon proved unsatisfactory, and a steam-shovel was set to work. The first one proved too light and a was set to work. The first one proved too light and a second was obtained with a one yard bucket, though built for a yard and a half. This bucket cuts three feet wide and four to six inches deep and twenty-five feet vertically. and four to six inches deep and twenty-five feet vertically, and two yards, sufficient to make 1,000 brick. can be dug and handled in less than one minute, or enough for 225,000 bricks in ten hours, including shifting, etc. Two-yard dump-cars were at first used to transport the clay, but, as it kept one man busy all the time to repair them, a section of track was arranged to tip with the car on and secured to it, which was found economical and satisfactory.

The cars are drawn by a hoisting drum over a platform on which the clay is dumped, and from which it is fed to two Cockell pulverizers which whittle the clay into small chips. From these the clay passes to the brick machines, one to each pulverizer, with an average capacity of 44,300 bricks in ten hours, from which the newly formed bricks are run on cars into the eleven drying tunnels, ninety-four feet long, from which the steam is removed by exhaust fans. They will thoroughly dry 50,000 bricks in twenty-four hours. Artificial drying costs less than out-of-door drying.

The following force make, dry, and set in the kilns an average of 177,200 brick per day: Four machine men, four boys on platform, eight men at pulverizers, two men at hoisting machines, one engineer on steam shovel, one foreman on steam-shovel, one craneman on steam-shovel. six men in clay bank, twelve boys loading cars with green bricks, four men putting cars in dryer, four men to fire dryers and remove cars, four men to do the same at night, twenty-four men setting and wheeling, one engineer, two foremen, one carpenter, one blacksmith, three laborers—

total, eighty-three.

Very satisfactory experiments have recently been made in burning the brick with crude oil. Two million one hundred thousand brick have been thus burnt, but the results, though very promising, are not yet considered con-

A paper by Mr. Jose R. Villalon was also read by the author, describing the manufacture of author, describing the manufacture of brick from the ground refuse of slate quarries at Phillipsburg, N. J.

"These slate brick are very hard, ring well, are compact and homogeneous, fine grain, free from pebbles, and

pact and homogeneous, fine grain, free from pebbles, and rarely crick; their color varies from light rose to Philadelphia brick red. They do not shrink or warp in burning, and cut easily with the trowel. They are very strong and absorb very little water, so they make a dry wall and do not suck the moisture from the mortar. Their eost is, for pressed brick, \$12 to \$20 per M., and for paving-brick, \$12 to \$13. For the latter purpose they are specially suited, as they are readily cleaned and do not hold ice like other pavements."

The papers were discussed by Mr. Calvin Tomkins,

The papers were discussed by Mr. Calvin Tomkins. who gave information regarding the manufacture of brick on the North River and in New Jersey. The want of uni-formity in size of brick he attributed to unequal shrinkage in the burning.

AMERICAN WATER-WORKS ASSOCIATION.

(From our Corresponder t.)

The eighth annual meeting was held in Cleveland, O., April 17th, 18th and 19th, President J. T. Fanning, of Minneapolis, Minn., presiding. The first session was held Tuesday morning, and after the transaction of regular business the society listened to a paper by the president on "Water-Supply Treatments and Sources."

At the afternoon session invitations were received from City Engineer Rice, The Globe Iron Co., Lake Shore Foundry and others to visit their works and shops, and a committee was appointed to make suitable arrangements.

The reports of executive and finance committees were

The secretary reported that during the last year 44 active, 5 associate and 1 honorary member had been elected, and that 7 members had been lost by death or resignation, leaving a net increase of 43.

The society now numbers 210 active, 54 associate and 1 honorary members.

The last year's total receipts were \$1,080.25. of which a cash balance of \$156.55 remains. This report was approved and accepted.

The death was announced of John Ryle, of Paterson, N. J., and of W. C. Stripe, of Keokuk, Iowa. Mr. Stripe was closely identified with the growth of the society and was one of its most efficient laborers.

A committe was authorized to prepare obituary memoirs. Papers were read on "The Sanitary Protection of Rochester's Water Supply," by Chief Engineer J. Nelson Tubbs; "The Use of Salt-Glazed Vitrified Pipe," by S. E. Babcock, C. E., and "Consumption of Water by Cities and Towns," by H. W. Avers, C. E.

Mr. Y. Nakajima not being present to read his paper on the "Water-Supply of Tokio, Japan," it was omitted from the programme, but directed to be printed in the proceedings as appearing with the rest.

The reading of the papers was followed by interesting discussions, which we will present in another issue, and will report the transactions of the subsequent sessions.

Many guests of the association, and a number of exhibitors of special articles for water-supply and kindred uses. were in attendance.

The following members were present: Chas. P. Allen, Denver, Col.; H. W. Ayres, Hartford, Conn.; S. E. Babcock, Little Falls, N. Y.; C. E. Borke, Cleveland, O.; Calvin S. Brown, New York, N. Y.; D. M. Clark, Elyria, O.; Edwin Darling, Pawtucket, R. I.; A. N. Denman,



Des Moines, Iowa: I. M. Diven, Elmira, N. Y.: H. F. Dunham, Cleveland, O.; J. T. Fanning, Wilkesbarre, Pa.; E. W. Frost, Colorado Springs, Col.; L. H. Gardner, New Orleans, La,: W. S. Hamilton, Youngstown, O.; J. W. Henion, St. Louis, Mo.; Frank W. Holly, Lockport, N. Y.; Thos. N. Hooper, Davenport, Iowa; Geo. Hornung, Newport, Ky.; A. J. Jones, New Brunswick, N. J.; J. P. Maxwell, Boulder, Col.; Wm. Molis, Muscatine, Iowa; B. R. Morton, Newport, Ky.; Chas. N. Priddy, Leadville, Col.; W. G. Richards, Atlanta, Ga.; Wm-Ryle, Paterson, N. J.; Benj. F. Stephens, Flatbush, N. Y.; John W. Troy, Pierre, Dak.; J. Nelson Tubbs, Rochester, N. Y.; T. Woodruff, Bridgeton, N. J.; Fred Adee & Co., New York, N.Y.; Richard Beaumont, Kankakee, Ill.; J. B. Clow & Sons, Chicago, Ill.; Columbus Water Works, Columbus, O.; Hersey Meter Co., Boston, Mass.; E. H. Kellogg & Co., New York, N. Y.; Lake Shore Foundry, Cleveland, O.; A. W. Morgan, Buffalo, N. Y.; H. Mueller, Decatur, Ill.; R. D. Wood & Co., Philadelphia, Pa.; H. R. Worthington, New York, N. Y.; Wortley, Ted & Co., Kansas City, Mo.

The following were elected officers for ensuing year: A. N. Denman, of Des Moines, President; J. N. Diven, of Elmira, W. G. Richards, of Atlanta, John W. Henion, of Minneapolis, Charles U. Priddy, of Leadville, and H. W. Ayers, of Hartford, Vice-Presidents; J. H. Decker, of Hannibal, Mo., Secretary and Treasurer. The next annual meeting will be held in Louisville.

The reports of papers and discussion on them we are obliged to defer for a subsequent issue.

LONDON CORRESPONDENCE.

\$5,000 for Essay on Water-Supply—Gas in Madrid
. Theatres Prohibited—Electrical Railway in Vienna
—A Patent Decision—Midshipmen to be Instructed
in Steam Engineering.

THE King of the Belgians offers a prize of 25,000 francs for the best work on the question of water for towns, referring specially to Brussels and its suburbs. The competition essay may be in any language and in either manuscript or printed form. Competitions must be received before January I, 1893, at the Bureau of the Minister of Public Works, Brussels. Existing works, unless materially altered, and in the form of a new edition published between 1889 and 1892, are not available to take part. No particulars are announced as to the judges, but in any case the universal value of the competition, which is, of course, in the first instance, specially for Belgium, is apparent.

A REUTER's telegram from Madrid states that the regulation as to the abolition of gas in the theatres, and the universal substitution of the electric light, has just been officially notified. The change must be made within five months from date.

MESSRS. SIEMENS & HALSKE, the electrical engineers, have had an electrical tramway in regular work for some months past in Vienna. The current is supplied by a fixed dynamo. Conductors, resting on iron chains, in a masonry channel, and in contact with which are two sliding shuttles, run the whole length of the line, which is about eleven kilometres. Steel-wire spiral cords act as transmitters of power from the motor-spindle to the car-axles.

A PATENT case of unusual form has just been settled on appeal in the House of Lords. The Limited Horse Shoe and Nail Co. sued a Glasgow firm—Messrs. John Stewart & Co.—for infringing patent rights in selling horse-shoe nails, manufactured in Sweden by machinery which infringed the patents of the Horse Shoe Co. Damages were laid at £10,000. At the first trial damages were awarded the plaintiff company £530, but on appeal by the defendants these were reduced to £50; the House of Lords have, however, confirmed the first judgment. The principle that goods made abroad by machinery patented in England and put upon the market here by firms other than the patentees of the machinery are thereby constituted infringements of patents.

THE Admiralty have taken a step in the right direction with regard to the better education of midshipmen in the questions of steam and marine engineering. Before passing as a sub-lieutenant a midshipman must, in future, produce a certificate from the engineer of his ship, countersigned by the captain, testifying that the applicant has been on duty a certain number of hours in the engine-room, has a practical knowledge of the various parts of the ma-

chinery, and has proved himself competent to run a service steamboat. The last qualification he must have acquired during his final year of service as midshipman. Hitherto no special facilities have been afforded for acquiring the information, but in future the midshipman will take the stoke-hole and engine-room in his regular watch-

FINE SANITARY SYSTEM.

AN OHIO TOWN WHICH IS A LITTLE AHEAD OF KNOXVILLF.

(From the Knoxville Times.)

THE Board of Health of the city of Knoxville, the Board of Public Works, the City Council, and in fact all the city authorities will be delighted to read a description of the sanitary system which resembles the sanitary arrangements of Knoxville in many respects. Dr. T. C. Hunter, of Napoleon, O., makes the following report to the State Board of Health of Ohio:

"We have no board of health, and no health officer, as

"We have no board of health, and no health officer, as the members of the Council seem to consider them expensive and useless appendages. They pay but little attention to sanitary science. We have as many privy-vaults, cesspools, and stables as are usual in county seats fifty years old; we endeavor to keep all the filth produced on and in the soil. It is true that we have a good deal of sickness from impure water, but think it cheaper to bury a few than to clean up. When any one dies of preventable disease, we piously say, 'The Lord gave, and the Lord hath taken away.' We feel satisfied, as we know the Lord is long suffering and kind, and that He seems willing to bear all the blame. As the latter (of three sewers) is the pride of the town, I will describe it. It is 18 inches in diameter, and extends about 3 squares, where it finds an immense catch-basin. From the catch-basin a two-food sewer runs to the canal, two squares. The sewage is carried under the canal by a culvert three feet square, and thence to the river through a 15-inch sewer-pipe. The catch-basin is lined with brick four inches thick, and is deep enough to hold 300 barrels of filth before it will reach the outlet. This will necessarily hold the amount of sewage all the time, and give an opportunity to filter through the brick walls, and thence reach the neighboring dwellings and wells. The joints of the sewer-pipe are loosely placed together without cement of any kind. They are warranted to leak at every joint. The cellars and privy-vaults on the street are connected with the sewer by six-inch sewer-pipe. They are all made large, as we all know that the liquid portion will leak out at the joints, and leave the solid portion to ferment and furnish an abundant supply of sewer gas for the use of the people. The water-supply for the sewer is the rainfall on about forty acres of land. There has never been more water in it than would run through a four inch pipe.

would run through a tour inch pipe.

"The subject of water-works has been discussed a little within a few weeks on account of the discovery of an abundant supply of pure soft water gushing out of the gravel at the foot of the bluff on which our principal cemetery is located."

NOTES ON BRICKS.

MR. D. RAMÉE, in the London Architect, says that three main points with reference to bricks have to be taken into account: (1.) The power of resistance under pressure; (2) the appearance of the fracture, which should present an even texture, and a fine and brilliant grain. without cavities in the interior, and neither ribbony nor stony; (3) the exterior, which should be smooth and regular, the angles and edges sharp and straight. When the size of the bricks is equal throughout the mass it is a proof that the brick earth has been well prepared and the bricks generally well made. A brick when struck should give forth a clear ringing sound. Good bricks are generally of a dark reddish brown color, and sometimes they show vitrified spots on the surface; it is not well, however, to depend too much on this last fact, for it is often only an indication of the amount of heat to which the brick has been subjected, while the clay of which the brick is made Bad bricks are may be impure and ill-prepared. readily recognized by their reddish-yellow color, but still more by the dull sound which they emit when struck; their grain being soft they crumble easily and absorb water with avidity. A good brick should not absorb more than about one-fifteenth of its own weight of water; it should appear, and in reality be, dry. A brick that does not take up any water at all is too muchy burnt; the mortar adheres to it imperfectly, but it is a good conductor of heat. Such bricks may be used in damp soil and for pavements. When a brick left in water either scales or swells, it is of bad quality, and contains caustic lime. A brick which, being made red-hot, and then having water poured on it, does not crack, is of extraordinary and rare quality; and those which have borne the effect of moisture and dryness during two or three winters without scaling or cracking are excellent. In order to try if bricks will bear the effect of frost, let one be boiled for half an hour in a solution of sulphate of soda, saturated /

cold, and then suspended by a string over the vessel in which it has been boiled. In twenty-four hours the surface of the brick will be covered with small crystals; the brick is then to be immersed again in the solution until the crystals disappear, and again suspended, repeating this operation for five days, the crystals reforming after each immersion. If after this treatment a number of particles of the brick are found at the bottom of the vessel containing the solution, the bricks are incapable of supporting the effects of frost.

OBITUARY.

DR. CORNELIUS REA AGNEW.—This distinguished eye and ear specialist died at his home in New York City on the 18th inst. He had been in good health until recently.

Dr. Agnew was born in New York City in 1830, and was of Huguenot, Scotch, and North Irish extraction. From Columbia College he was graduated in 1849, and then began the study of medicine under Dr. J. Kearney Rogers. In 1852 he received his diploma from the College of Physicians and Surgeons, and soon after was appointed House Surgeon to the New York Hospital, and then its Curator. Then he accepted the position of Surgeon to the Eye and Ear Insirmary, but made it a condition that he should first go to Europe to complete his studies.

Returning to New York in 1855, he started in practice for himself. The next year he married Mary, daughter of Lora Nash, a merchant in this city. Governor Morgan appointed him Surgeon-General of the State of New York, and at the outbreak of the war the Governor appointed him Director of the State Volunteer Hospital, New York. When the United States Sanitary Commission was organized Dr. Agnew was elected a member, and although he had a large private practice he devoted all the rest of his time at great personal sacrifice to the succor of the soldier. The life-saving work of the Commission at Antietam, the battles of the Wilderness, and the relief to the wounded and sick soldiers who returned from Southern prisons was made so successful principally by the carefully arranged plans of Dr. Agnew, which were superintended by him.

Dr. Agnew was one of the four gentlemen who founded the Union League Club in this city that gave so great material assistance to the Government during the war, and he became one of its vice-presidents,

In 1866, at the request of the Faculty of the College of Physicians and Surgeons, he established an ophthalmic clinic there, and in 1869 he was elected Clinical Professor of Diseases of the Eye and Ear. The following year he organized the Brooklyn Eye and Ear Hospital, and also the Manhattan Eye and Ear Hospital, the latter in this city. He had been appointed in 1865 one of the Managers of the New York State Hospital for the Insane at Poughkeepsie, and was twice reappointed.

As early as 1859 Dr. Agnew was elected a trustee of the public schools in this city, and was made president of the board. Several years later he was selected a trustee to organize a School of Mines in Columbia College, and in 1874 he became a trustee of that college. In 1872 he was chosen president of the Medical Society of the State of New York. He was secretary of the first Sanitary Reform Association organized in this city, and one of the committee which made the first draft of the health laws of the city.

BUILDING OF THE \$2,500,000 CRUISER.

SECRETARY WHITNEY has written a letter of instruction to Rear Admiral Gherardi, commanding the New York Navy Yard, in regard to the projected construction at that yard of an armored cruiser to be known as the "Maine," provided for by the act "to increase the navy establishment," approved August 3, 1886. The limit of cost, excluding armament, is \$2,500,000.

PERSONAL.

MR. ROBERT GRANT, author and lawyer, has been appointed to succeed Col. Horace T. Rockwell as Water Commissioner.

C. A. GOMPERT, architect, having returned from Europe, has resumed the practice of his profession at Milwaukee, Wis.

CHIEF ENGINEER D. J. WHITTEMORE, of the Chicago, Milwaukee & St. Paul road, who has for the past four weeks been confined to his house almost uninterruptedly with a slight attack of pneumonia, is improving in health, and expects to be out shortly.

DR. C. P. WILKINSON has been elected President of the Louisiana State Board of Health, vice Dr. Joseph Holt, resigned and removed from the State. He is a graduate of the Washington and Lee University and of the Louisiana Medical University.

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CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

DF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

WE have received from Henry S. Northrop, orner Centre and Franklin Streets, New York, is new catalogue, illustrating his "paneled sheet-iron ceilings," showing plan, sections and details of executed work, and giving information of interest to architects and builders.

WE have received the catalogue of J. B. ohnston, 119 Lake Street, Chicago, illusrating a line of builders' hardware, house rimmings, stone-work, and stable fittings, selected for illustration with a view to meet 'all but the most exceptional requirements," and will be sent free to architects and builders.

ARCHITECTURAL COMPETITIONS.

DENVER, Col.-Plans are wanted here until June 11 or a court-house. For c reular of instructions address loseph H. Smith, County Clerk, Arapahoe County, as above.



For works for which proposals are requested see the "Proposal Column," pages i-vii-viii-308-ix.

Persons who make any use of the information they find in these columns we trust will not count to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

RIVERSIDE P. O., MASS.— WATER.— Concerning water-works matters here, our correspondent writes: "The Riverside water-works have been in operation for several years. The owners have asked for a charter so that they might have rights in the highway and take water from other sources, but do not intend putting in new works at present."

CHICAGO, ILL.—WATER.—Mr. Yerkes is preparing plans for a thorough overhauling of the Washington Street tunnel. It is reported that a new tunnel will practically be built inside of the old one, at a cost of about \$100,000.

PEMAQUID, ME.—DRAINAGE.—J. E. Nichols, Secretary of the Pemaquid Land Company, writes: "We have not surveyed and plotted all our land. It is uncertain about our taking any measures for drainage this season."

DOVER, N. H.—WATER.—The Boston Herald says: "It has been voted that the plans of Percy M. Blake, of Hyde Park, Mass., for water-works be accepted. The contracts for piping and special castings for said water-works were awarded to the Camden Iron-Works, of Philadelphia, Pa., for \$68,951.

Chetopa, Kan.—Water.—Our correspondent writes regarding the water project here: "No definite arrangement made as yet, but will be this summer. Will keep you informed."

YOUNGSTOWN, O. — WATER.— Our correspondent writes: "There is talk of putting a filter in the water-works here, to cost \$35,000."

OMAHA, NEB.—Sewers.—George W. Tillson, City Engineer, writes: "We are not improving our sewerage system, but are gradually extending it. Last year we constructed is. I miles of sewers, and expect to do as much this season. We now have about fifty miles of brick and pipe sewers. A portion is the separate system complete, another portion storm water exclusively, and still a third of the combined."

POWTLAND, ME.—WATER.—Seth L. I arrabee, of the Diamond Island Water Company, regarding reported water-works scheme, writes: "We shall open another spring and set up another wind-mili, giving another source of supply. Sha'l erect an additional tank and extend our supply-pipes to take in about twenty additional houses. The enterprise is designed for summer cottages."

JERSEY CITY, N. J.—WATER.—The Board of Public Works has again postponed the date of opening bids for the improved water supply, the new date being May 7. See our proposal column.

SANTA CRUZ, CAL.—WATER.—W. H. Bias, the city clerk here writes: "The city bought the present water-works system, but the bonds were not legal; so the business will have to be gone through again."

MINNEAPOLIS, MINN—WATER METERS.—In view of the increas d consumption of water, resulting from the continued growth of the city, Water Registrar Moody has recommended that the city furnish meters to consumers, chaiging a small rental for the same.

WASHINGTON, MO.—WATER.—The proposals for the water-works system at this place, which were to have been opened April 2, will not be opened until May 10. For additional details see our Proposal Column.

FORT RILEY, KAN.—WATER.—Our correspondent writes: "Bids are to be opened for a water-works plant at Foit Riley, Kan., May 9. The system includes driven wells, one million-gallon compound duplex pump, a 500,000-gallon reservo r, some four miles of mains, boiler house and residence, etc. J. B. Johnson is consulting engineer." See our Proposal Column.

Dubuque, Iowa.—Sewers.—It is probable that eps will soon be taken towards the construction of the roposed sewerage system for this place.

PITT-BURG, KAN—SEWERS.—Two surveys have already been made for the sewerage system to be established here, and specifications and estimates are now being prepared. As soon as the details are completed and the necessary ordinances passed the work will be commenced.

BELLWOOD, PA.—WATER.—The Bellwood Water ompany has been incorporated here with a capital of 15,000. R. G. Ford and others, incorporators.

BUSHNELL, ILL.—WATER.—At an election held here April 17 the people decided in favor of establishing a \$10,000 system of water-works.

TACONY, PA.—WATER.—A petition has been presented to the City Conneil of Philadelphia from the Disston Water Company asking permiss on from the Council to lay water-pipes in this pace to supply the residents with water. It was stated in the petition that it would cost Philadelphia \$05,000 to supply lacony with water from the Wentz farm reservoir. The matter was laid over.

GREENVILLE, MISS. — WATER. — The Greenville Water Works Company has been incorporated here. Capital, \$75,000. L. Mettesser, and otners, incorporators.

WAYLAND, MASS.—WATER.— It is reported that the people of this place anticipate establishing a waterworks plant and a sewerage system.

LIGONIER, IND.—WATHR.—It is reported that a system of water-works is to be established here. Address the Town Clerk.

GLEN ELDER, KANS.—WATER.—Bonds are to be issued for the construction of a system of water-works.

PARKHIIL, ONT. — WATER. — It is reported that Deputy Gibbs can furnish details of a water-works

CHICOUTIMI, QUEBEC.—WATER.—It is reported that water-works are to be established here.

water-works are to be established here.

Memphis, Tenn — The Memphis Artesian Water Co., successors to the Memphis Water Co., contemplate extensive additions to their plant, in which is included a steam-pipe, two neighbor plant, pumps, two miles of 36-inch pipe, besides several miles of 20-inch, to-inch and 10-inch, and smaller sizes. Some thirty mills will be connected to the new pumping-plant. How much of this plant is not yet contracted for our correspondent has neglected to inform us.

Mr. W. L. Cameron, for many years superintendent of the old company, has charge of local construction, Mr. Thos. J. Whitman, of St. Louis, being the consulting engineer.

GIRARD KANSAS.—WATER.—Our correspondent writes: "This city would like to have proposals for the construction of a complete set of water works. Contractors to own works and furnish water to city at annual rental, on thirty-year contract. The city has a population of 3,200, has three railroads and is about to build another. Coal can be delivered here at seventy-five cents per ton. There is being built an exensive zinc smeller, and the city has just ordered a survey for a sewerage system." For further information address James S. James.

KINGSTON, ONTARIO.—WATER.—The time for re-ceiving proposals for the water-tower and engine has been extended until May 8. See our Proposal Column.

WATER-WORKS.—See our Proposal Column.

Water-Works.—See our Proposal Column for information regarding water-works and water-works supplies at the following places: St. Augustine, Fla., Washington, Mo., Girard, Kan., Pittsburg, Pa., Allegheny, Pa.

BRIDGES.

Austin, Texas. — The county commissioners are taking steps toward the erection of a \$60,000 bridge here. The surveys are already being made. Mayor Nalle can furnish details

Washington, D. C.—The Senate has passed the House bill to authorize the construction of a bridge across the Ohio River, at the head of Brunot's Island.

NEWARK, N. J.—The joint committee of Essex and Hudson County Freeholders on the new bridge over the Passaic pass'd the following resolutions April 17. Resolved, That this special committee recommends the building of a bridge in the Twelfth Ward, Newark, both counties concurring; and, further, that the location of said bridge be from the loot of Chambers Street, Newark, and Fourth Street, Harrison. Resolved, That our county engineers be instructed to procure plans and specifications of said bridge and meet the committee at a meeting to be held April 23 at this place.

SHORT CREEK, W. VA.—A bridge is to be erected here by the Brook County Commissioners.

STRAFFORD, N. H.—It is reported that the select-men will erect a bridge here, and that details can be had of James S. Stiles.

SAN MIGUEL, CAL.—It is reported that a bridge is to be built here by the County Commissioners.

STAUNTON. VA.—An iron bridge is to be erected over the Middle River, in Augusta County. G. C. Bruce of this place is preparing the plans.

Grand Forks, Dak.—It is reported that the County Commissioners will erect two bridges over the Red River at this place, the total expenditure to be \$75,000.

PIERRE, DAK.—A company has been formed here to construct a bridge between this place and Fort Pierre, at an estimated cost of \$30,000.

BRIDGES.-See our Proposal Columns for information regarding bridge construction at the f llowing places: Laurel, Md.; Pittsburg, Pa.; Clinton, Mass.; Denver, Col.; Boston, Mass.

GAS AND ELECTRIC-LIGHTING.

RED OAK, Iowa.—An electric-light plant is to be established here.

HAVELSON, MASS.—It is proposed to establish gas-works here.

CHICAGO, ILL.—Chief Engineer Gerecke and Professor Barrett are at work making the plans of the engines for the new electric-plant for street lighting. The plant will be located in the same building as the river-light plant.

GRAVESEND, N. Y.—The Atlautic Flectric-Light Co. has been incorporated here. Capital, \$25,000-James J. Powers and others, incorporators.

JOLIET, ILL.—The Joliet Flectric-Light Co. been incorporated here. Capital, \$50,000. Lew Ingalls and others, incorporators.

Georgetown, D. C .-- The Potomac Electric-Light and Power Co. has been incorporated here. J. W. Thompson and others, in corporators.

STREET-WORK AND PAVING.

OMAHA, NEB.—Geo. W. Tillson, City Engineer, writes us as follows: "We expect to ay about 400,000 yards of pavement mostly coan block on a concrete base and curb the same streets, which will take not less than 20 miles of curbing."

RAILROADS.

TIFFIN, O.—A street-car line is to be built here by local capitalists.

FLUSHING, L. I.—For details of street-railroad construction here address Dennis Sullivan, contractor, as

BIDS OPENED.

HOLTON, KAN.—BRITGE.—The following bids for constructing bridge across Soldier Creek, 20-foot span, 12-foot roadway, were received by Board of County Commissioners of Jackson County. April 13: Massillon Bridge Co., Massillon, O., \$1,125; Canton Wrought Iron Bridge Co., Canton, O., \$1,054; King Iron Bridge and Manufacturing Co., Cleveland, O., \$1,057; Smyth Bridge Co., Toledo, U., \$1,175; Lane Bridge and Iron Worss, Chicago, Ill., \$1,004; Columbia Bridge Co., Toledo, U., \$1,180; J. C. Chase, Holton, Kan., \$1,070; J. M. Ferguson, Holton, Kan., \$1,000; Kansas City Bridge and Iron Co., Kansas City, Mo., \$1,087.

ALBANY, N. Y.—RESERVOIR, ETC.—The following bids for building reservoirs and laying pipe lines were received by the Secretary Special Water Commission March 29: Cranford & Valent ne, Brooklyn, N. Y., \$271,594; Jacob Holler, Albany, N. Y., \$435,127.59; Sullivan & Eklers, Albany, N. Y., \$421,015.59; Houlihan & Flagler, Cohoes, N. Y., \$485,628.83; John H. O'Rourke, Brooklyn, N. Y., \$490,357.92. Contract awarded to Cranford & Valentine.

OREGON CITY, OREG.—BRIDGE.—The County Court of Clackamas County on April 7, awarded a contract for the construction of a bridge across the Willamette River at this place to the Pacific Bridge Company, of San Francisco, for \$23,000.

San Buenaventura, Cal...—Sewers.—The following bids for constructing a system of sewers for this city, were opened April 6, postponed from April 2, by J. F. Newley, Clerk: Walker a Mahoney, Los Angeles, Cal., \$23,855.34; Alex McBean, San Francisco, Cal., \$23,873.82; M. Macdonald, San Bernardino, Cal., without iron pipe outfall. 5co feet, \$18,695.63; Hobson & Wilkinson, Ventura, Cal., \$18,705.90; San Francisco, Sewer-Pipe Association, for iron stone pipe only, delivered on ground. \$5,533.08; G. D Vincent, San Francisco, Cal., \$25,004.90, no bid on 12-inch iron pipe.

cisco, Cal., \$25,004.90, no bid on 12-inch iron pipe.

MILWAUKRE, WIS.—SEWER-WORK.—The following contracts for street-work were awarded April 13 by the Hoard of Public Works: Jacob Werner, sewer on Highland Boulevard, \$3,20 for 30-inch brick and \$1.70 for 18-inch pipe sewer; Daniel Driscoll, sewer on Fowler Street, \$3,70 for 36-inch and \$3.40 for 30-inch brick, and \$1.85 for 18-inch pipe and \$1.50 for 15-inch pipe sewer; also sewer on North Avenue, \$0, \$6.80, \$4.80, \$3.50 and \$7, for 72, 48, 42, 36 and \$4-inch sewer respectively per lineal foot. The bids of J. C. F. Brand and Charles Brand, for building the sewer in an alley in blocks 37 and 38, in the Fifth Ward, were at \$3.25 each per foot.

and 38, in the Fifth Ward, were at \$3.25 each per foot.

OAKLAND, CAL., B-IDGE.—The following bids for reparing the bridge at Alvarado were opened April 11 by a committee of the Board of Supervisors: W. T. Vettch, \$1.53 per linear foot; Alex. Thomson, \$1.78 per linear foot; Gran er & Son, \$1.39 per linear foot; Pacific Bridge Co., \$26 per 1,000 feet of lumber used; Pacific Bridge Co., \$26 per 1,000 feet of lumber used; John K. Carpenter, \$1.38 per linear foot; San Francisco Bridge Co., \$1.30 per linear foot; William McDonald, \$1.37 per linear foot; C. L. Crissman, \$1.28 per linear foot. The contract was awarded to the California Bridge Company.

MAYFIELD, Ky., COURT-HOUSE. -- The contract for erecting the court-house here has been awarded to M. T. Lanman & Co., of Jeffersonville, ind., for \$12,397.

CAMBRIDGE, CHIO.—WATER-WORKS.—Only one bid was received by the Council, and opened April 16 for constructing a system of water-works here. No action was talen, but it is probable that at the first meeting of the new Council, to be held May 7, the work will be readvertised.

NEW YORK CITY.—BUILDINGS.—The Commissioners of Charities and Correction opened the following b ds April 13, for the erection of two groups of buildings of three pavilions rach, at Central Islip, L. I.: Joseph Moose, \$64,000; W. S. Velsor, \$60,000; Hamilton & Henry, \$73,500; William Livingston, \$75,563; James Brady, \$93,000. No award was made.

Philadelphia, Pa.—Bridge Removal.—The following bids for the removal of the Market Street bridge over the Schuylkill River and the removal of the stone preis were opened last week by the Bureau of Survey: William K. H. Achuff, \$6,000 for removal of bridge; \$4,000 for removal of piers; Connell & Keenan, \$1,500, \$7,500 for the respective works; Jones & Benner Co., \$1.070, \$8,850; J H Hathaway, \$1,700, \$4,000; American Dredging Co., \$8,700, \$1,200; William C. Lovengen, \$4,000; 55,000; D. S. Coffrode, \$800, \$5,000; Colfrode & Suitor, \$7,500 for the removal of the bridge, and J. E. Robinson bid \$5,600 for removing the piers. D. S. Coffrode was awarded the contract for removing the bridge work, and American Dredging Co. the work of removing the stone piers.

St. Cloud. MINN.—Bulldings.—Bids for the new

ST. CLOUD, MINN.—BUILDINGS.—Bids for the new McCormick block have been opened as follows: Kropp Bros. of this city had lowest bid, \$21,325; the Kropp Bros. of this city h highest bid being \$34,850.

GOVERNMENT WORK.

PHILADELPHIA, PA.—REMOVAL of WRECK.—Abstract of proposals for removal of the wreck of the steamer "Blanche Henderson," lying in the Delaware River, at Philadelphia, Pa., opened April 12 by Lieut.-Col. Henry M. Robert, Corps of Engineers: Elihu J. Morris and Charles W. Johnston, Lewes, Del., \$5,049, John F. Baxter, New Vork, N. Y., \$3,750 (teopomended for acceptance); William S. Mason & Co., Philadelphia, Pa., \$3,000 (informal).

ZANESVILLE, O.—TIMBER.—The following bids for furnishing timber for the Muskingum River were opened April 2 by Lieut.—Col. W. E. Merrill, Corps of Enemers: Bids for price pir M., Joshua R. King, Belpre, O., \$10; John F. King, Belpre, O., \$22; Irish & Warner, Marietta, O., \$21.22; Hayes Broth rs & Woodruff, Vincent. O., \$21.50; J. R. Gorby, Bell Valley, O., \$21.50; Marietta Chair Co., Marietta, O., two bids, \$17 and \$24, St. H. Stinchcomb, Malta, O., \$21.75; Patterson, Buigess & Co., Zanesville, O., \$22.90; W. H. Taylor, Duncan's Falls, O., \$27.

H. Taylor, Duncan's Falls, O., \$27.

WASHINGTON, D. C.—WIRE.—The following bids for furnishing the Signal Service, U. S. A. with 20 miles wire, No. 14, according to specifications, were opened April 7, by A. W. Greely, Chief Signal Officer: Washburn & Moan Manufacturing Co., 6 cents per lb.; E. S. Wheeler, steel, per lb., 4.40c.; E. B. B., 6.23c.; B. B., 5.19c.; The Trenton Iron Co., pr ib. 4.95c.; Jas. W. Queen & Co., \$6.50 per mile: John A. Roebling, Soos & Co., 4%c, per lb.; E. G. Criffith, 7.4c, per lb.; E. S. Greely & Co., 4 cents per lb., in bot d; R. A. Robbins, 4.74c. per lb. The award was made to E. S. Greely & Co.

award was made to E. S. Greeley & Co.

ZANESVILLE, OHIO.—GATE ANCHORIGES.—The following bids for gate anchorages for the Muskingum River, were opened April 2, by Lieut.-Col. W. E. Merrill, Corps of Engineers: Griffith & Wedge Co., Zanesville, Ohio, \$1,824; Queen City Bridge and Steam Forging Co., Cincitnati, Ohio, \$1,862; The King Iron Bridge and Manufacturing Co., Cleve and, Ohio, \$2,261; Chester B. Albee, Alleghany. Pa., \$2,394; Sharon Boiler Works, Sharon, Pa., \$2,470; Charles Barnes, Cincinnati Ohio, \$2,293.

DAVIDS ISLAND, N. V.—PLUMBING, ETC.—The following bids for plumbing, etc., in the large bairacks, at this place, were opened April 19 by George H. Cook, Captain and A. Q. M., U. S. A. Depot Quartermaster: Dixey & lovey, Philadelphia, Pa., \$074; T. O. Howell, Jr., Philadelphia, Pa., \$1,297; R. A. Robbins, New York, \$2,247. The contract was awarded to Dixey & Dovey.

ZANESVILLE, O.—CEMENT.—Abstract of proposals for cement for Muskingum River, opened April 2, by Lieut.—Col. W. E. Merrill, Corps of Engineers:

Natural	Portland (
Cement.	Portland Cement.	
James B. Speed, Louisville. Ky	T. B. Townsend & Co., Zanesville, O., John W. Dickinson, Chicago, Ill	BIDDERS.
\$1.30 1.35 1.40 1.80	\$2.70 2.75 3.06 3.10 3.10 3.30	Per barrel.
1,000 bbls. \$6:0 675 700 900	\$00 bbls. \$2,70 \$2,700 3.060 3.060 3.000 3.300 3.300 3.300 3.300 3.300 3.300 3.300	Aggregate.
,000 bls. \$650 Black Diamond. 675 700 700 Rosendale.	bbls. \$2.70 \$2.700 Columbus. 2.75 2.760 3.060 3.06 3.060 3.10 3.000 Gibbs and Black Cross. 3.30 3.300 K. B. & S. 3.44 3.140	Brand of Cement.

Janesville.—Iron Drift Bolts.—The following bids for furnishing iron crift-bidts for the Muskingum River were opened May 2 by Lieutenaut-Colonel W. F. Merrill, Corps of Engineers: M. Lanz & Sons, Pittsburg, Pa., \$1.275.70: Ihomas Carlin's Sons, Allegheny Pa., \$1.298.62; Chicago Forke and Bolt Co., Chicago, Ill., \$1,321.30; Pittsburg Manufacturing Co.,



Pittsburg, Pa., \$1,382.54; Charles Barnes, Cincinnati, O., \$1,312.10; Oliver Brothers & Phillips, Pittsburg, Pa., \$1,316.05; Central Bolt Works, Cincinnati, O., \$1,457.20; Queen Citt Bridge and Steam Forging Co., Cincinnati, O., \$1,560; L. Schrieber & Sons Co., Cincinnati, O., \$1,747.87; L. F. Smith, Zanesville, O., \$2,1248.38; King Iron Bridge and Manufacturing Co., Cleveland O., \$2,385.88.

DALLAS, TRX.—STEAM-HEATING, ETC.—The following bids or the steam-heating and ventilating apparatus for the court-house were opened April 17 by the Supervising Architect of the Treasury Department; Bartl-tt, Haywood & Co., \$4,960; Sam'l I. Pope & Co., \$4,970; Marriam & Co., \$5,000; Crook, Horner & Co.,

ROCHESTER, N. Y.—COURT-HOUSE,—The following bids for iron work of third story and attic floor, attic and court-room ceilings, etc., and the iron, wood, slate and copper of roof complete, were opened April 17 by the Supervising Architect of the Treasury Department; H. A. Edgerton, \$46,396; John Siddons, \$40,500.

\$49,509.

ZANESVILLE, OHIO. —DIMENSION STONE. —The following bids for dimension stone, for the Muskingum River, were opened April 2, by Lieut.—Col. W. E. Merrill, Corps of Engineers: E. M. Ayers, Zanesville, Ohio, per cubic yard, \$2.69, total, \$2.690; T. B. Townsend & Co.. Zanesville, Ohio, per cubic yard, \$2.980; citalse & Gormley, Luke Chute, Ohio, per cubic yard, \$2.99, total, \$2.990; Williams & Fouts, Eaglewort, Ohio, per cubic yard, \$3.25, total, \$4.35, total, \$4.35, total, \$4.35, total, \$4.45, total, \$4.450; Henry Erbes, Harmex, Ohio, per cubic yard, \$3.40; Henry Erbes, Harmex, Ohio, per cubic yard, \$4.40; Henry Erbes, Harmex, Ohio, per cubic yarg, \$4.50, total, \$4.500.

THE RIVER AND HARBOR APPROPRIA-TIONS BILL.

The bill as reported by the committee provides about nineteen and one-half million dolars for the construction, repair and preservation of river and harbor works. A large proportion of the sums specified are for continuation and completion of work that has been commenced, and the total sum is increased on account of no appropriation having been made last year.

Vermont—Harbots—\$35,000.

Massachusetts—Harbots. \$372,500, of which \$125,000 is for Boston, and \$100,000 for Sandy Bay; Rivers, \$5,500.

Khode Island—Harbors, \$22,000; Rivers, \$00,000; to be expended on the Pawtucket and Providence Rivers and Nairagansett Bay.

Connecticut—Harbors, \$131,000, of which \$75,000 is for New Haven Breakwater; Rivers, \$50,000.

New York—Haidors, \$959,500, of which \$200,000 is for Buffalo, \$100,000 for Oswego, and \$380,000 for New York City; Rivers, \$522,500, of which \$75,000 is for Buffalo, \$100,000 for Oswego, and \$380,000 for the Hudson, \$150,000 for the Harlem, and \$250,000 for the Hudson, \$150,000 for the Harlem, and \$250,000 for the Hudson, \$150,000 for the Harlem, and \$250,000 for the Hudson, \$150,000 for the Harlem, and \$250,000 for the Sasaic and \$45,000 for the Passaic and \$45,000 for the Raintan.

Penisylvania—Harbors, \$08,000, of which \$83,000 is for Fire tarbor and Pre-que-isle: Rivers, \$335,000, of which \$250,000 for the Delaware.

Delaware—Harbors, \$127,500, of which \$100,000 is for the Delaware.

Nersham—Harbors, \$258,000, of which \$250,000 is for the Baltimore: Rivers, \$25,000 is for Norfolk; Rivers, \$360,500, of which \$250,000 is for Norfolk; Rivers, \$360,500, of which \$250,000 is for the Iames and \$100,000 for the York.

West Virginia—Rivers, \$562,233.13, of which \$32,500 is for the Big Sandy, \$300,000 for the Great Kanawh, \$250,000 for the Little Kanawha, \$250,000 for the Cape Fear.

South Carolina—Harbors, \$457,500, of which \$350,000 are for Chaileston and Sullivan's 'sland, ard \$100,000 for the Great Pee Dee, and \$24,000 for the Santee. 000 for Winway Bay; Rivers, \$102,000, of which \$20,000 is for the Great Pee Dee, and \$24,000 for the San-

coo is for the Great Pee Dee, and \$24,000 for the Santee.

Georgia—Haibors, \$246,500, of which \$112,500 is for Cumberland Sound, and \$39,000 for Savannah; Rivers, \$163,500, of which \$20,000 is for the Chattah ochee, and \$60,000 for the C osa.

Florida—Harbors, \$112,500; Rivers, \$214,500, of which \$150,000 is for the St. Johns.

Alabama—Harbors, \$250,000 for Mobile; Rivers, \$162,000, of which \$20,000 is for the Alabama, and \$100,000 for the Black Warrior.

Mississippi—Harbors, \$18,500; Rivers, \$107,500, of which \$27,000 is for the Pascagoula and \$32,000 for the Yazoo.

Texas—Harbors, \$975,000, of which \$100,000 is for Aranas Pass, \$500,000 for Galveston Bay, and \$250,000 for Sabine Pass and Blue Buck Bar; Rivers, \$37,500.

(hino—Harbors, \$98,002,000, of which \$75,000 is for Cleveland, \$60,000 for Muskingiim River Ice Harbor, and \$150,000 for Toledo; Rivers, \$647,000, of which \$530,000 is for the Ohio and \$100,000 for the Muskingiim.

Indiana—Harbors, \$05,000 for Michigan City: Pivers

um. Indiana—Harbors, \$05,000 for Michigan City; Rivers or Indiana and Illinois), \$320,000, of which \$65,000 for the Wabash, \$50,000 for the Calumet and \$200,-

to for the Illinois.

Illinois—Harbors, \$245.400, of which \$220,400 is for

Illinois—Harbors, \$245,400, of which \$220,400 is for Calumet.

Michigan—Harbors, \$402,000, of which \$70,000 is for Sand Beach; Rivers, \$1,778,000, of which \$30,500 is for Sand Beach; Rivers, \$1,778,000, of which \$30,500 is for the Detroit, \$500 oo for Hay Lake Channel, \$65,000 for the St. Clair Flats Canal and \$1.000,000 for the St. Mary.

Wisconsin—Harbors, \$273,500, of which \$70,000 is for Milwaukee and \$60,000 for Ashand; Rivers, \$117,500, of which \$100,000 is for the Fox.

Minnesota—Harbors, \$10,000, of which \$80,000 is for Duluth; Rivers, \$30,000.

California—Harbors, \$448,400, of which \$150,000 is for Humboldt, \$175,000 for Oakland, and \$00,000 for Wilmington; Rivers, \$50,500, of which \$25,000 is for the San Joaquin.

(Iregon—Harbors, \$170,000, of which \$25,000 is for the San Joaquin.

Coos Bay and \$120,000 is for Yaquima; Rivers, \$60,500, of which \$175,000 is for the Cascade Canal, \$350,000 for the Columbia River, \$80,000 for the Clower Williamette and Columbia, and \$22,000 for the Coquille.

Nower Willamette and Columbia, and \$22,000 for the Coquille.
Louisiana—Rivers, \$315,500, of which \$35,000 is for the Atchafalya, \$65,000 for the Red, \$100,000 for the

Bayou Plaquemine and \$50,000 for the Bayou La

Arkansas—Rivers, \$164,900, of which \$125,000 is for the Arkansas.

Arkansas—Israel, \$100,000 of which \$200.000 is The Cumberland and \$250,000 for the Tennessee. Kentucky—Rivers, \$191,000, of which \$180,000 is for e Kentucky.

Missouri—Rivers, \$712,500, of which \$694,000 is for

Kentucky,
the Kentucky.
Missouri—Rivers, \$712,500, of wince
the Missouri.
Washington Territory—Rivers, \$19,500.
And for the Mississippi River at different points of
course, \$3,881,350.

(Continued from page viii.)

APRIL 19, 1888.

APRIL 19, 1888.

SEALFD PROPOSALS will be received at the office of Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 18th day of May, 1888, for the labor and materials required in the erection and completion of U. S. Post Office, etc., building at Owensboro, Ky., including approaches, vault doors, etc., in accordance with the specifications and drawings, copies of which may be seen at this office, at the office of the Superintendent, Permanent Exhibit and Exchange, Cheago, Ill.; Builders' and Traders' Exchange, Louisvi'le, Ky.; Builders' Exchanges, Cinicinnati, O., and Indianapolis, Ind.; Master Builders' Association, Baltimore, Md.; Mechanics' Exchange, 5t. Louis, Mo., and at the Mechanics' and Traders' Exchange, New York, N. Y. Each old must be accompanied by a certified check for \$500. WILL, A. FRERET, Supervising Architect.

SEALED PROPOSALS will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 10th day of May, '888, for the labor and materials required for the completion of the roof of the Court House and Post Office at Des Moines, Iowa (including terra-cotta roof-tile and arches, wrought-iron down pipe, cast-iron drains, copper and slate work complete) in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Super-intendent, the Builders' and Traders' Exchange, Chicago, Ill., the office of the Builders Exchange, Pattsburg, Pa., the Builders Exchanges at Indianapolis, Ind., and Cincinnati, O., the Builders and Traders' Exchanges at Louisvile, Ky., and Kansas City, Mo., the Contractors and Builders' Exchange at St. Paul, Minn. and the Builders' Exchange at Detroit, Mich. Each bid must be accompanied by a certified check for \$300. WILL, A. FRERET, Supervising Architect.

PROPOSALS FOR REPAIRING COAL WHARF,
—Depot Quartermaster's Office, David's Island,
N. Y., April 16, 1888.—S-aled proposals, in triplicate,
are invited, and will be received until WEDNESDAY,
May 16, 1888, 12 o'clock, noon, and opened immediately
thereafter in the presence of bidders, for the repair of
the Coal Whart at David's Island. Specifications, etc.,
will be furnished on application. The right is reserved
to reject any or all proposals. Proposals should be
endorsed, "Proposals for Repairing Coal Whart,"
and addressed to GFO. H. COOK, Captain and A.
Q. M., U. S. A., Depot Quaitermaster. 24

ABUTMENTS, BOSTON, MASS—Proposals are wanted, until April 23, for building masonry abutments for Harvard Bridge over Charles River, between Cambridge and Boston. Address Hugh O'Brien, Commissioner of Harvard Bridge, Mayor's Office, as above.

BRIDGES, TRESTLE, AND ABUTMENTS, DENVER, COL.—Proposals are wanted, until May 2, for erecting, etc., complete ready for travel, the iron trestle and truss bridges and the Fourteenth Street viaduct, together with all iron abutments, piers, stone footings, etc., according to specifications. Address M. J. McNamara, Presdent Fourteenth Street Viaduct Co., as above.

LUMBER, ROCK ISLAND ARSENAL, II.L.—Proposals are wanted, until May 2, for furnishing about 150,000 feet of white or Norway pine timber and plank. Address T. G. Taylor, Col. Ordnance Department, U. S. A., Commanding.

FIRE-PLUGS AND STOP-GATES. — ALLE-GHENY, PA.—Proposals are wanted until May 2 for furnishing fire-plugs and stop-gates, according to specifications. Address James Brown, Comptroller, as

CLEANING WATER-MAINS —ALLEGHENY, PA.—Proposals are wanted until May 2 for cleaning out the city's water-mains. Address James Brown, Comptroller, as above.

EMBANKMENT DAM, WHITINSVILLE, MASS.—Proposals are wanted until May 1 for building a 370 foot embankment dam, fifteen feet high, according to specifications. Address A. C. Moor, C. E., 100 Main Street, Southbridge, Mass.

RAILROAD, EAST SAGINAW.—Proposals are wanted for laying 50 miles of the track of the Saginaw Division of the Toledo, Saginaw & Mackinaw R. R., also Rolling Stock and equipment. No date specified Address Wm. Doherty, Superintendent of Construction, as above.

HIGH SCHOOL BUILDING, PEPPERELL, MASS.—Proposals are wanted until April 30, for the erection of a high school building. Address F. W. Ames, Clerk, Building Committee, as above.

VIADUCT. — DENVER, COL. — Proposals are wanted until April 25 for 'ron abutments and piers, stone footings, iron trestle, roadway, walk, truss skewspan, etc., for the Fourteenth Street viaduct. Address Lourie & Aulls, Engineers, Pioneer Building, as above.

SEA WALL. BOSTON, MASS.—Proposals are wanted until April 30, for constructing 850 feet of substantial sea wall, according to specifications. Address Jarvis D. Braman, President Charles River Embank ment Company, No. 85 Milk St., as above.

COURT HOUSE, ABBEVILLE, LA. - Pro-osals are wanted until April 25, for the erection of a ourt house. Address W. W. Edwards, as above.

BRIDGE MASONRY.—PITTSBURG, PA. -Proposals are wanted until April 25 for the masonry for three bridges. Address Josiah Speer, County Controller, as above.

PROPOSALS.

DREDGE SUPPLIES, ETC. - DETROIT MICH.—Proposals are wanted, until May 7. for a dredge, tug, two scows, timber, coal and general supplies, for removing shoals at Sand Beach, Harbor of Refuse, Lake Huron. Address Lieut.—Colonel O. M. Poe, U. S. Engineer Office, as above.

WATER-SUPPLY.-JERSEY CITY. WATER-SUPPLY.—JERSEY CITY, N. J.—Proposals are waited, until May 7, for furnishing a pure supply of water to Jersey City; water to be supplied into Reservoirs Nos. 2 and 3, on Bergen Hill, Jersey City, and into the high-service system of distribution pipes of Jersey City, at an effective head in such high-service pipes of 100 feet above high-water level in Reservoirs Nos. 2 and 3, in accordance with specifications. Address Martin Finck, Clerk Board of Public Works, as above.

BUILDING - NEW YORK CITY. - Proposals are wanted until May a for an additional story to washhouse, chanty hospital, Blackwell's Island, New York, Addiess the Department of Pub'ic Chantes and Correction, No. 66 Third Avenue, as above.

BUILDING -NEW Y')RK CITY.—Proposals are wanted until May 3 for an addition to the main building, to be used as a kitchen, dining-room and washhouse, at the Work-house, Blackwell's Island. Address the Department of Charities and Correction, No. 66 Third Avenue, as above.

BUILDING.—ST. PETER, MINN.—Proposals are wanted until May 17 for building a d-tached ward to second hospital at Rochester. Address A. L. Sackett, Secretary, as above.

CASTINGS. — PITTSBURG, PA. — Proposals are wanted until April 23 for furnishing sew r and gutter castings for one year. Address E. M. Bigelow, Chief of the Department of Public Works, as above.

GRANITE CROSSINGS.—PITTSBURG, PA.—Proposals are wanted until April 23 for furnishing granite flag-stone crossings for one year. Address E. M. Bigelow, Chief of Department of Public Works, as above.

BUILDING.—ALLEGHENY, PA.—Proposals are wanted until April 30 for the erection of a high school building, according to plans, etc. Address F. J. Osterling, Architect, as above.

BUILDING.—BOSTON, MASS.—Proposals are wanted until April 25, for building a patrol-wagon house, according to plans. &c. Address A. T. Whiting, Chairman Board of Police, 7 Pemberton Square, as above.

BRIDGE. — CLINTON, MASS. — Proposals are wanted until May 1, for building a wrought iron bridge for the town of Clinton, according to sp-cifications. Address S. Anderson, Road Commissioner, as above.

ROOF.—NEW YORK CITY.—Proposals are wanted, until April 30, for the work to be done in strengthening the trusses of roof of the New York State Arsenal. Address J. M. Varian, Chief of Ordnance, S. N. Y., as above.

PUMPING-ENGINES. — ALLEGHENY, PA.—
Proposals are wanted until May 2 for furnishing two
horizontal plunger pumping engines, outside packed,
each with a capacity of delivering 5,000,000 gallons of
water, 250 feet high, with a piston speed not exceeding 100 feet per minute, the city furnishing foundations
for the same. Address James Brown, Comptroller, as
above.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations: -b s, brown stone; br, brick; br st, brick store; br dwell, brown-stone dwelling; abart house; cre, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

Broadway, n e cor John st, br and iron office bldg; cost, \$250,000; o, Austin Corbin; a, S D Hatch; b, not selected.

4 5th av, r b s dw; cost, \$30.000; o, estate W C Rhinelander; a. H J Hardenbergh; b, J J l'ucker. 239-241 W 320, 2 flats; cost, \$17,000 cach; o, E D Bertine; a, Geo Kuster.

41st, s.s., 300 w 10th av, 1 br workshop; cost, \$40,000; o, Faul Bryibil; a, G B Pelham; b. J & S Weber. 86th, s s, 30 e roth av, 4 b s dws; cost, \$25 000 each; o, D Willis James; a, J G Prague.

130th, n s. 75 w 11th av, r br warchouse; cost, \$11,-000; o, A P Humphrey; a, J Henderson.
126th, s s. 80 e 3d av, 2 brick flats with stores; cost, \$18,000 each; o, T F Cook; a, J C Burne. 132d, n s, 175 w 6th av, 9 b s dws; cost, \$9,000 each; o, Anthony McRevnolds; a, W H Boylan.

141st, 100 e Boulevard, 5 br dws; cost, about \$10,000 each; o, J C Gillies; a, M J Fitz Mahoney.

148th, s. s., 150 e Brook av. 12 frame dws; cost. \$2,700 each; o, Wallenstein & Hecht; a, R E Rogers.

Loring pl. e. s., 50 s. 184th, 1 fr. dw; cost, \$7,500; o, C R Appleton; a and b, B F Frisbre.

40 and 42 Seventh st, 2 br flats; cost, \$36,000 all; 0, Julius Langenbaden; a, Friest W Gries.

58 Irving pl. br apartment house; cost, \$15,000; 0.
Louis P Rollwagen; a, same as above.

S s 41st st, 300 w 10th av. br machine factory; cost, \$40,000; 0, Paul Bryib'l; a, Geo B Pelham. 3474 N 3d av, br store and dw; cost, \$12,000; o, Geo A Seabold; a, Jas S Wightman.

N s 130th st. 70 w Alexander av, 2 br dws; cost, \$11,000; 0, Annie Arctander; a, Arctander & Meyer.

235 E 115th st, br dw; cost, \$12,000; 0, Chas Hahn; a, Adam Niunch. W s Lexington av, 84 s 79th st, br dw; cost, \$15,000; o, E S Cornwell; a, G A Schillinger.

161 East 118th st, br dw and store; cost, about \$12,000; o, Ed Sweeny; a, J C Burne.

BUILDING INTELLIGENCE

NEW YORK CITY-Continued. N s 122d st. 130 e 3d av, br ten; cost, \$16,000; aux; a, John E Kerby.

325 E rooth, br dw; cost, \$9,500; 0, John Kelija, W Fernschild & Son

Se cor 7th av and 121st st, 3 brdws; cost, \$5,000.

o, H J McLucken; a, John H Friend

137 2d st, br dw; cost, \$20,000; o, Sutersof \$100.

inic; a. W Schickel & Co.

41 and 43 New st and 50 Broadway, bt effections, \$175,000 all; o. J. N. Stearns; a, B. L. Gilbert.
S. e. cor 86th st and 10th av, br dw; cost, \$17.00
D. W. James; a, J. G. Prague.

S w cor 7th av and 14th st, br dw and store 40,000; o, A Meinken; a, Jas W Cole.

S w cor 116th st and 4th av, br dw; cost, \$30.00 Thos P Dunne; a, owner.

40 Stanton st, br dw aud store; cost, \$18.00; 6.16. Guitschow; a, J Boekel & Son. 428-432 Bro.dway, br bldg for store purpose of \$130,000 all; o, Estate of Letitia A Politon, decise Chas De Kay Fownsend, L Bradford Prime, Italia, S. A. Warner.

, S A warner.

S w cor Church and Walker sts br store; con too; o, D Brandes; a, G H Budlong.

457-459 West 47th, br dwell; cost \$12,000; 0, FEat lett. Jr. Cutting Estate; a, G P Sampers. 2,018-2,020 Fifth av, 2 br flats; cost, \$20,000; c, H? De Graff; a, S Robinson.

ALTERATIONS-NEW YORK

209 Ave A, br dw and stores; cost \$9,000; 0, M ? Ochs; a, F Ebeling.
154 W 53d st, br dw; cost, \$10,000; 0, W Rabb; 1
Geo Keister.

BROOKLYN.

Fulton st, Flatbush and Nevins st, r brick and sandstone store; cost, \$100,000; 0, Willard F Smi and W G Randolph; a, P J Lauritzen.

Carroll st, n s, 82 e 5th av. 12 stone dws; cost, \$12,000; 0, Julia A Walker; a, A Spence; b, Kelly fire. S s Pacific st. 150 w Court st, brachool; cost, \$15,000, Board of Education; a, Jas W Naughton.

S e cor Verona and Van Buren Sts, brdw; cost, \$15,000; 0, T Thorntly.

Se cor Lincoln pl and 8th av, br dw; cost, \$1000 o, W H Stubbins; a, Chas Werner. Es 8th av, 22 s Lincoln pl, 4 br dws; cost, \$5000 o and a, same as last.

S s Cranberry, 64 w Hicks st, 2 br dws; cost, \$11.00 all; o, Abraham Schenck; a, W J Kerngan.

212 N 8th st, I fr dw; cost, \$7,000; 0, Mn A lakbeau; a, Th Engelhardt.

nauja, in Engelnarde.

N w cor Stuyvesant av and McDonough st, brd# 105
10,000; 0, H C Johnston; a, Burhans & Davidoe.

N s Monroe, 50 e Stuyvesant av, 5 br dwells; 05
10,000 ail; o and a, W F Clayton.

S s Cooper, 80 e Broadway, 12 br dwells; cost, \$\infty\$ coo all; 0, Jas Schmitt; a, F Holmberg.

N s Melrose, 200 e Central av, 2 fr dwells; cs. \$8,000 all; 0, M Bisgmann; a, Th Engelhardt.

N s North 10th, 125 w Bedford av, notc, therefore, cost, \$25,000; 0, St George Roman Catholic Charles, Benj Finkenseiper.

Es Luqueer, 200 from Henry, 2 br dwells; cost, \$15.000 all; 0, John Plate; a, H Gilvary.

N s Hayward, 120 from Lee av, br school; cost, \$45.00; o, Board of & ducation; a, J W Naughton. New Lots Road, br school; cost, \$19,000; 0 and a. 15

South 3d, nr Ferry, br school; cost, \$37,000; 0 and a

S s S 5th st, 100 w Hewes, brick dw; cost, \$6.500 0. Fred Fred; a, A Herbert. 413 Broadway, br flats; cost, \$8,000; o, R Losg: 4, W J Conway.

E S Morgan av, cor Scholes and Meserole, from sheds; cost, \$15,000; o, C H Reynolds; a, Th Enghardt.

N w cor Madison st and Lewis av, brick dws; cost.
\$11,000; 0, T P Eryant; y, I D Reynolds.
E s To npkins av. 60 s Lafayette av. 2 br dws: cost.
\$20,000 all; 0, R A Phillips; a, Amzi Hill.

MISCELLANEOUS.

ANN ARBOR, MICH.—Stores will be built bere to cost \$20,000.

YOUNGSTOWN, O .-- Lloyd, Booth & Co., Founders, of this city, are making improvements plant to cost \$15,000.

MILWAUKEE, WIS.—S w cor Brady st and Prospect av., stone dw: cost, \$16,000; o, D Adler; a, A C Clos; b, open.

Arlington pl, fr curler's rink; cost, \$7,000; 0, Milwaukee Curling Club.

Ne cor 15th and Fowler, addn to factory; cost.
\$5,000; 0, Milwaukee Casket Co.

Ne cor Martin and Jefferson, 3 story brick dr. 70x3c; cost, \$13,000; o, Hermann Wootch.

West Water near Fowler, br and stone warehoest.

Set, \$50,000; o, Flint and Pere Marquette Kailmad
ompany.

Ne cor Grand av and 7th st, c-story br block of flats; cost, \$80,000; o, Mr Hutchinson.
36 buildings less than \$7,000.

KANSAS CITY, MO.—roth cor Forest av, brick dv. cost, \$7,000; o, Aug Kochler.

Jefferson and S W Boulevard, brick stores; cost.
\$40,000; o, Geo J Gray.

14th cor Tracy av, 6 brick dws; cost, \$25,000; 4 Tribbie & Day. 17th cor Tracy av, 4 br dwells; cost, \$18,000; 0. W W Perkins.

W W Perkins.

2116-17 Madison av, 2 br dws; cost, \$15,000; 0, 1

G H Copley.

Fairmont Park, 3 fr dws; cost, 10,000; 0, J Osler.

12 h cor Tracy, br dw; cost, \$9,000; 0, A P Smith.
85 buildings costing less than \$7,000.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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FINANCIAL HISTORY OF GAS-LIGHT-ING IN GREAT BRITAIN.

A VERY interesting chapter in "Burdett's Official Intelligence" for 1888 is on "The Official Intelligence for 1888 is on "The Financial History of Gas-Lighting" in Great Britain. Parenthetically we may say that the "Official Intelligence" is a "Précis of Information regarding all British, American, and Foreign Securities," edited by Mr. Henry C. Burdett, of London, and now in its seventh year.

An opinion of the electric light is found in one of the opening sentences, to the effect that it "cannot at present compete commercially with gas, and has not, therefore, as yet made any great progress as a general illuminant." Undoubtedly this industry is in a more promising condition with us than in England.

The first public street-lighing with gas took place in Pall Mall in 1807, and as an outgrowth of this experiment the Chartered Gas-Light and Coke Co. was organized, receiving a royal charter in April, 1812.

According to a return presented to the House of Commons in 1847, there were at that time 128 companies established by Act of Parliament. In 1866 the number had increased to 175 with a combined capital of £15,246,727. The Board of Trade returns, which were first made in 1882, gave, at the end of 1886, 164 gas undertakings belonging to the local authorities, and 378 belonging to companies. The total authorized

capital was £73,069,670, and the total quantity of gas sold was over eighty billion cubic feet.

With regard to the powers of existing companies, it is stated that although a company authorized by Parliament to supply gas in a dis-trict could rest assured that under ordinary circumstances no other company would be similarly authorized for that district, it is competent for any person or body of persons, without Parliamentary authority, to build gas-works and distribute gas within an area already occupied by an authorized company. Unauthorized companies are, however, liable to many annoyances and dangers not met by those working under Parliamentary sanction.

The statement that the "supply of gas by municipalities has proved very popular and successful, as well as economical," does not agree with the results of similar experiments in this country. There are twenty-nine cities, with above 50,000 population, which at the present time are supplied with gas by stock companies. The most important of these are London, Edinburgh, Liverpool, Sheffield, Dublin and Bristol.

In speaking of the dividends paid by gas companies Mr. Burdett states that according to returns made in 1850 there were 134 companies in existence. Of these nineteen were paying the maximum dividends of 10 per cent.; ten between 9 and 10 per cent.; seven from 8 to 9 per cent.; thirty-six from 6 to 8 per cent.; and thirty-two less than 6 per cent.

"Practically it may now be said that the large majority of gas companies in successful working (excluding new undertakings and those which for temporary reasons have lately diminished their dividends), are paying the full dividends to the state of the large st

dends authorized by law."

"The maximum price of gas which may be charged is usually settled by the special Act of the company," and varies according to the size of the town, etc. While the law makes it compulsory upon a company to supply gas to all applicants, it permits a reduction in price to large

From the first introduction of meters down to about the year 1832 the price was 15s. per 1,000 feet, and from this

date the price was gradually reduced until, in 1840, the date the price was gradually reduced until, in 1849, the metropolitan companies were supplying common gas for 6s. per 1,000 feet. "It is only in small places nowadays that as much as 5s. has to be paid for gas."

At the end of 1886 eighty-eight companies out of 539 were selling gas at less than 3s. per 1,000 feet.

By an order of the House of Commons power is given to a "committee to which a gas bill is referred so to regulate the price of gas to be charged to consumers, that any reduction of an authorized 'standard rate' shall entitle the company to make a proportionate increase of the authorized dividend, and that any increase above the standard price shall involve a proportionate increase of dividend." "The scale of increase and decrease which may be regarded as practically universal, is that 'for every penny or part of a penny charged in excess or in diminution of the standard price in any year, the standard rate of dividend shall for such year be reduced or increased by five shillings in the hundred pounds per annum."

The adoption of this plan, which is known as the "sliding scale," has resulted in a considerable reduction in the price of gas. The latter part of Mr. Burdett's paper is devoted to a more detailed history of gas-lighting in the metropolis.

DR. CORNELIUS R. AGNEW.

By the death of Dr. Cornelius R. Agnew, By the death of Dr. Cornelius R. Agnew, which occurred April 18, after a brief illness, New York City has lost one of its most public-spirited and valuable citizens. He took an active interest in the work of Columbia College, of which he was one of the trustees; was influential in the organization of the School of Mines, and was especially interested in the Department of Biology and Hygiene of that institution. While his practice was confined that institution. While his practice was confined to the diseases of the eye and ear, he was active in the promotion of all medical, educational, and sanitary interests, and being a man of broad culture, having extensive general information and a ready use of pen and tongue, he was able to exercise a powerful influence among those with whom he was associated in many different fields of usefulness.

His services to the U.S. Sanitary Commission in the late war will long be remembered, and we quote the following letter, as it indicates his feelings toward soldiers at that time:

To the Editor of the Evening Post:

SIR: Permit me to place one flower on the grave of Dr.

Since retain the to place one nower of the grave of Bi.

C. R. Agnew, in grateful remembrance of his kindness to soldiers during the late war.

I was severely injured in the eye while fencing with a brother officer at the headquarters of the Army of the Potomac. Gen. Meade's Surgeon-General advised that 1 Potomac. Gen. Meade's Surgeon-General advised that I should at once be sent to Dr. Agnew in New York, and this was done. For thirty days Dr. Agnew's care was bestowed upon me with marvellous skill and the tenderness of a loving parent. At the end of that time I was able to return to duty, when, upon asking the Doctor for his bill, he laid his hand on my shoulder and looked into my eyes and said: "Captain, what I have done for you is only an expression of what I feel is due to every man who wears your uniform. You do not owe me anything."

On my way back to the army I met a captain of artillery whose hearing had been injured by the bursting of a shell near his head. We had met often at Dr. Agnew's office, and, on comparing notes, each learned of the Doctor's generous kindness to the other.

Only a few people know of Dr. Agnew's devotion to the men of the army. To me, "The world seems lonely without him."

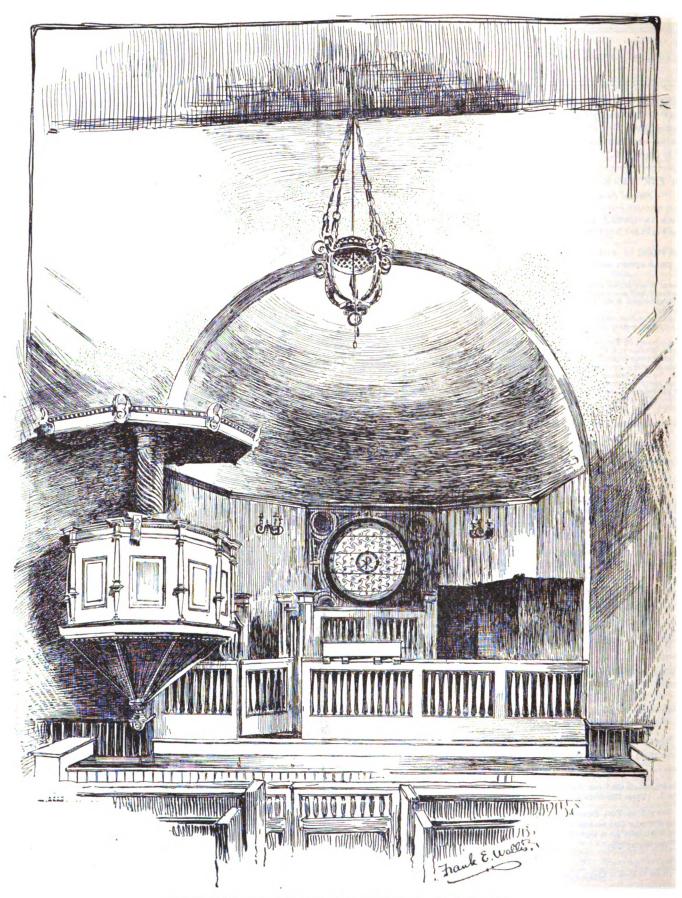
Respectfully yours,

AN EX-OFFCER OF THE U. S. ARMY.

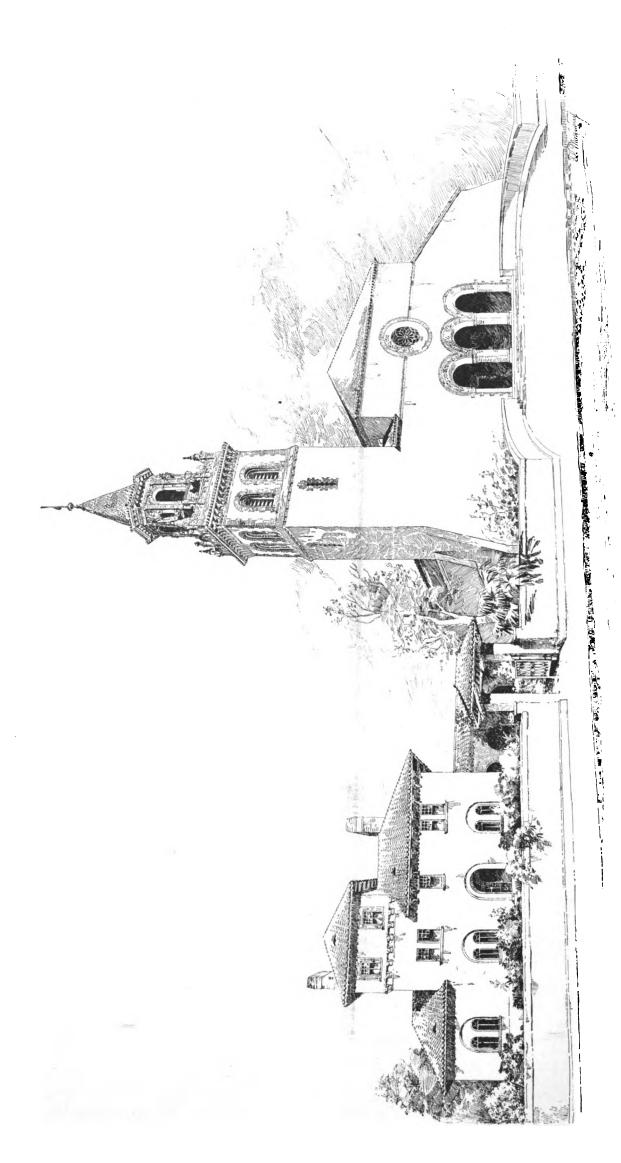
He took a warm interest in the work of this

He took a warm interest in the work of this journal, and was always ready to furnish it with advice and information.

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PULPIT IN THE METHODIST EPISCOPAL CHURCH, ST. AUGUSTINE, FLA.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

THE METHODIST EPISCOPAL CHURCH AT ST. AUGUSTINE, FLA.

We deplore his death as a calamity to the whole community and as leaving a vacant place in many circles which it will be difficult, if not impossible, to fill.

NO MORE BUILDINGS IN NEW YORK CITY HALL PARK.

WE are glad to note that the opposition of this journal, followed by the Real Estate Record and of some of the leading dailies of this city, rotably the *Tribune*, to the proposed scheme for meumbering the City Hall Park with additional buildings, has had such influence with the Legislature that the Assembly, by unanimous vote, has passed the bill prohibiting the erection therein of the new building for the criminal courts, and in the law authorizing the erection of a new Hall of Records there is a similar provision. The bill has also been favorably reported in the Senate. Its becoming a law, however, sho uld not be in any way construed to prevent the payment of the promised premiums to those who, with that inducement, have submitted competitive designs for the proposed buildings in good faith. These designs represent much honest hard work that should not lose its reward merely because the authorities have wisely changed their minds. In this matter of compensation it is gratifying to note that the Sinking Fund Commissioners will have expert assistance in the persons of several well-known archit ects to be selected from a number whose names have been submitted by the New York Chapter of the American Institute of Archi-Their influence will no doubt secure tects. justice to the competitors.

OUR ARCHITECTURAL ILLUSTRATIONS.

ST. A UGUSTINE M. E. CHURCH AND PARSONAGE.

THIS building was recently erected largely at the expense of Mr. H. M. Flagler, the owner of the Ponce de Leon Hotel. It is built of the same material, shell concrete and terra cotta. The architects were also Carriere & Hastings, of New York.

PULPIT IN THE METHODIST EPISCOPAL CHURCH, ST. AUGUSTINE, FLA.

THE MONEY VALUE OF VENTILATION IN WORKSHOPS.

A PAPER on this subject was read by Mr. Joseph Corbett at a recent meeting of the Manchester Association of Engineers, and abstracted as follows in the London Architect: The author maintained that in engineering workshops each man should have at least 25 square feet of floor area and at least 400 cubic feet of space for comfortable ventilation. The quantity of fresh air required per man per hour was not less than 1,000 cubic feet, even in cold weather, and with inactive employment; from four to ten times that amount was required for laborious work in warm weather. In arranging for the ventilation of a workshop, people might take the simple course of making openings in the walls, windows or roof, the currents in and out of the building depending on the wind and on the rise of temperature. Such means, however, afforded only inadequate and contradictory means of ventilation. With regard to cowls and whirligigs, which depended on the wind for their action, it might be said of them that they were most active when least wanted, and were least active when most wante-d; indeed, he thought there were few mechanical appliances by which the public was more humbugged and more completely sold than by the various wind whirligig ventilators which were successfully puffed and advertised by many persons. After describing, with the aid of diagrams, various methods of ventilation, Mr. Corbett said the best of all known means for inducing and regulating the ventilation of workshops were fans driven by power. In most workshops the power could be given by shafting, or steam could be supplied to a little engine attached to the fan. In some cases it would, he considered, pay well to apply a zas-engine for the purpose, the power required being very small compared with the results attained. Thus, one Indicated horse-power would under lavorable conditions drive 12,000 cubic feet of air per minute, or 720,000 cubic feet per hour in and out of a workshop, which was equal to the draught of about 200 parlor chimneys, and afforded the minimum ventilation

required for 720 workmen. Even in mild weather, when tenfold ventilation was required, it would serve 72 men. With such a power at hand there was no excuse for illventilated workshops, for all the risks of back-draught and the irregularities and contrarieties of wind ventilation were overcome by the power fan, which would by the simple regulation of its speed give as much or as little air as was required. The fan should be fitted to the outlet, as it was difficult to disperse its violent draught when used on the inlets; and as only one outlet was best for each room, that was the one place for the fan. An outlet shaft would be required, as the fan could not advantageously discharge through a side opening, which might meet the pressure of strong wind at times. Sometimes, where dust had to be kept down, and had to be carried away from lathes, etc., it was convenient use the space under a boarded ground floor as the exhaust chamber leading to the fan, each lathe, etc., having an exhaust pipe through the floor, and one or more pipes being laid down from near the ceiling to carry off the gas fumes, etc. In concluding, Mr. Corbet said that by proper attention to health in the workshop any man now working in an uncomfortable and unhealthy shop might be made at least one per cent. abler, more active, and more efficient in his work. Taking an average workman to be worth £100 a year to his employer, that one per cent. meant £1 per year, or equal to £20 of capital. All that he had suggested would not cost £20 per man, in most shops not £5 per man. He hoped, therefore, that both on the low ground of mere money value and on the high ground of duty to workpeople his paper would convince employers of the true economy of health in workshops.

AN ARCHITECTURAL COMPETITION IN ENGLAND.

THE ideal competition, from the standpoint of the more grasping promoters, is one so arranged that the amount of blackmail levied from the competitors for plans and particulars, etc., would balance the expenditure on premiums. We have apparently an instance of an attempt to adopt this ingenious arrangement in a competition hailing from the island of tripeds and feline monstrosities.

The wide-awake directors of the Villiers Hotel Company (Limited), Douglas, Isle of Man, are prepared to receive any number of designs, showing the laving out of their property, with an hotel, boarding-houses (plural), and lock-up shops (ditto). The would-be competitors must expend one guinea on lithographed plans of site, etc., without, so far as I can see, any hope of ever seeing it again. In consideration of the services of the profession, the directors offer premiums of £30, £15, and £5 respectively. The directors, doubtless, having heard of the rush for the great half-timbered compet tion, reasoned in this wise: "According to 'Cocker, £30 + £15 + £5 = £50 =total amount expended on premiums. If we can induce fifty impetuous voung architects to subscribe fifty guineas, by charging for particulars, the competition will not only be charging for particulars, the competition will not only be self-supporting, but prove a remunerative undertaking, yielding a profit equal to five per cent, per a very few weeks." Behold their ingenuity! The competition pays its own way and a percentage into the bargain.

Such a farce, happily, is impossible. Although the possibility of attracting a large number of competitors may lurk in the minds of the directors, they appear, in the advertisement, to be most well-meaning towards architects.

vertisement, to be most well-meaning towards architects. Therein they set forth the conditions they will observe, should there be only two or three competitors! This is about the number that I trust they will receive. I sincerely hope that all who respect their calling will refrain from subscribing to this charity for the benefit of the directors and shareholders of the Villiers Hotel Company (Limited). One might just as well pay the "one-pound-

one" direct into the coffers of the company.

Mark the grand extra inducement offered to competitors in this competition. The directors will exhibit the successful plans in their hotel during the coming season. As I have before observed, the next season in the Isle of Man is expected to be something almost too good. Hav-ing regard to this, it is a pity the folk there cannot offer the work hinted at above, another scheme is required, showing the property laid out to suit the architect's own views as to what would be the most successful financially. It only remains to say that, in the advertisement of this new 'plum," I do not find any definite promise as to the carrying out of work.—London Building News.

THE commencement of the works for the Manchester Ship Canal has emphasized the necessity of providing a good system of sewerage for the city, as, at the present time, a good deal of offensive matter finds its way into the river and creates a nuisance. Parliamentary powers are asked to borrow £450,000 for this purpose; the scheme being to acquire 95 acres of land to precipitate the sewage.

NEW EXPLOSIVES

In reviewing the recent additions to the explosive compounds placed upon the market, the Genie Civil attributes much the greater progress to Swedish investigators, and says that chemists have abandoned the old mixtures, based upon nitro-glycerine, and adopted these long since enumerated by M. Berthelot in his work "On the force of Explosive Materials."

Among the latest Swedish productions are: Romite, invented by Sjoberg. This is a fine yellowish powder, appearing like pounded fire-prick. It is composed of nitrate of ammonia, napthaline and paraffine mixed, chlorate of potassa and carbonate of ammonia, in variable proportions. It does not explode in free air, even in contact with flame; is insensible to shocks, however violent, receiving with impunity rifle-balls fired from a short distance. It is only exploded by a fulminate-of-mercury cap when confined in a closed space. Experiments in the mines at Christiania by a commission of engineers and artillery officers showed an efficacy nearly equal to that of dynamite and an action especially adapted to its use in quarries. Romite has been tried in fire-arms, where it gives greater initial velocity and less smoke than black powder, although the recoil appears to be more violent. For blasting, Romite is stated to be a rival of black powder, to which it is superior in force, though not quite equal to dynamite.

Bellite was patented at Stockholm in 1885 by M. Car. Lamm. and is composed of two solid elements-viz., a nitrate of either ammonia, potassa, soda or barytes, and a nitrate of some hydrocarbon, as bi-nitro-benzine, tri-nitro napthaline, etc. The two substances are reduced to powder and intimately mixed in a revolving cylinder, steam-heated to a temperature of 100° C.

Between 50° and 100° the hydrocarbon melts and forms a coating about the particles of the other nitrate. When cold it is pressed into cartridges and becomes hard and solid. Bellite does not freeze; it disintegrates at 90° C. and commences to evaporate at 200°. It burns with a sooty flame if suddenly heated, but the flame is extinguished it the external heat is withdrawn. It can be exploded either in an open or confined space by a fulminate-of-mercury cap, but not by shocks, flame, or a Bickford fuse. The gaseous products of its explosion are carbonic oxide and watery vapor.

M. Favier manufactures in Belgium an explosive anal-M. Favier manufactures in Belgium an explosive analogous to bellite, which is a mixture of mono-nitro-napthaline and nitrate of ammonia, which forms a fine, greasy, hygroscopic powder, with a sweet taste and smell of almonds and a specific gravity of 0.95. It cannot be exploded by shock or ignition. Two grammes of fulminate of mercury will explode it in the open air, but if the powder is compressed explosion will not be produced in a 40-rearmer cartridge with less than 14 grammers of fulminate. gramme cartridge with less than 14 grammes of fulminate, and the cartridge will not explode in free air at all, but only in a confined space.

RECLAIMING LAND IN EGYPT.

[Cairo Correspondence of the London Standard.]

I HAVE just returned from a visit to the Aboukir reclamation works, which are now well advanced. As this scheme has always been regarded more or less as a test of scneme nas always been regarded more or less as a test of the possibility of reclaiming salted land, too much importance can scarcely be attached to its success or failure. The concession, comprising about 30,000 acres, is the largest that has been made of late years, and if the result proves satisfactory similar concessions will probably quickly be given in other districts. The irrigation capals and proves satisfactory similar concessions will probably quickly be given in other districts. The irrigation canals and drains are already completed over about 12,000 acres, all converging on a point on Aboukir Bay, where two powerful Gwynne engines are discharging foul salt water into the sea at the rate of 240,000 tons every twelve hours, this water holding in solution 8,400 tons of solid salt. In the course of next week the machines will be kept working all the twenty four hours, when this amount will of course the twenty four hours, when this amount will, of course, be doubled. The same system will be applied next year to the remaining 18,000 acres, and it is hoped before long to offer the whole as a cultivable surface for the benefit of the town of Alexandria, which possesses scarcely any ara-ble land within a radius of ten miles. The experiment is being watched with the greatest interest, both by Alexan-drian speculators and by the authorities of the Departments of Finance and Public Works.

DULUTH'S WATER-SUPPLY.

DR. SHERWIN, in his annual report to the Board of Health of Duluth, recommends a general extension of the water-mains of the city so that the citizens may no longer be compelled to rely on wells and springs or the peripatetic water peddlers, which latter are alleged to get their supplies from very polluted sources. He also recommends that the intake of the water-works be moved to a point further down the lake further down the lake.

The Board has recommended the erection of a garbage

crematory like the one in Chicago.



AMERICAN WATER-WORKS ASSOCIATION.

(Continued from page 306.)

THE convention held morning and afternoon sessions on the 18th and 19th inst., at which most of the expected papers were presented and many points suggested by them discussed.

At the Wednesday morning session the Question Box was opened and the topics considered. In the evening the association accepted an invitation from the City Civil Engineers' Club to attend their regular meeting, where papers were read by Mr. John Whitelaw and Mr. A. W. Madison, respectively Superintendent and Secretary of the Cleveland City Water-Works.

The last session was devoted to committee work, election of officers, etc. Members were requested to prepare volunteer papers on "Use of Liquid Fuel," and "Flushing of Street Mains," and Messrs. Allen, Fanning, Gardner, Priddy, Harrison, and Gerecke promised to contribute papers on various subjects at the next meeting. The convention was then adjourned, to meet next year in Louisville, Ky. In the evening many of the members and their guests met at a banquet given by the association, and the following morning most of the delegates who remained were entertained by Mr. C. E. Burke by a carriage ride to the Lake Shore Foundry, the Cleveland Pumping Station, and other places of interest.

The following members of the association arrived after the list in last week's paper had been prepared:

Ezra Clark, Hartford, Conn.; F. L. Fuller, Boston, Mass.; R. M. Gow, Medford, Mass.; R. Holme, Denver, Col.; H. E. Keeler, Chicago, Ill.; and E. H. Phipps, West Haven, Conn.

During the convention the following members were elected:

E. C. Cooke, C. E., Tiffin, O.; C. A. Judson, Superintendent Water-Works, Sandusky, O.; J. S. Walker, Engineer Water-Works, Birmingham, Ala.; J. T. Lakin, Superintendent Water-Works, Rockford, Ill.; E. J. Snow, Constructor Water-Works, Brooklyn, N. Y.; F. W. Gerecke, Engineer Water-Works, Chicago, Ill.; J. A. Bond, Engineer Water Works, Wilmington, Del.; S. W. Harris, Engineer Water-Works, Racine, O.; J. Young, Hydraulic Engineer, Geneseo, N. Y.; T. J. Neville, Water Register, Rocl.ester, N. Y.; R. C. B. Bement, Engineer and Manager of Water-Works, St. Paul, Minn.; F. W. Sheppard, Manager Water-Works, New York; A. R. Wadsworth, Superintendent Water-Works, Farmington, Conn.; J. W. Taylor, Superintendent Water-Works, New Castle, Pa.; W. T. Harris, Secretary and Treasurer, Jackson, Tenn.; G. H. Benzenberg, City Engineer, Milwaukee, Wis.; P. Morley, Superintendent Water-Works, Liverpool, O., active members; and W. Oliphant, Cold-Water Filtering Co., Jersey City, N. J.; J. B. Edson, New York City; Rouse & Hills Co., Cleveland, O.; Jewell Pure Water Co., Chicago, Ill.; Hall Electric Pump Co., Plainfield, N. J., and W. D. C. Richards, New York, associate members.

We will give in this and succeeding issues abstracts of the papers read, with discussions on them.

CLEVELAND, OHIO, WATER-WORKS.*

I have been invited by the resident members of your Committee of Arrangements to prepare a brief description and history of the Cleveland Water-Works, and to read the same at this meeting.

the same at this meeting.

While I have been identified with these works two-thirds

of the period of their existence, and am therefore familiar with nearly every detail, I must confess that when called upon to write a description and give a historical sketch the task seems very much greater than when the subject was first suggested to me, and I make the attempt with no small degree of misgiving as to my ability to do the subject justice. subject justice.

The first definite action taken to procure a public water-

supply for the city of Cleveland was the appointment of Mr. T. R. Scowden as Engineer, who, on the 28th of February and afterwards in June, 1853, reported plans and estimates. Of three plans submitted, the one locating the works west of the mouth of the river was adopted, the water from this point being less liable to contamination by the discharges from the river. The work of construc-tion was commenced in 1854 and lake water let into the mains for the first time on September 24, 1856.

mains for the first time on September 24, 1856.

The reservoir had a storage capacity of 6 million gallons and was built on the top of an artificial bank raised 22 feet above the street-level. The engine-house, boiler-rooms and stand-pipe tower rested on a foundation laid on a solid timber raft, that in turn was laid on quick-sand. The pumping machinery consisted of one pair of purely Cornish beam engines, exact duplicates. The steam-

cylinders are 70 inches diameter with a stroke of 10 feet. The double beam is 29 feet 10½ inches between end centres. Width across the tulcrum, 6 feet 8 inches. Weight

of beam, with centre-shaft, is 40 tons.

The arms of the beam are unequal, the longer end connecting with the steam-cylinder being 15 feet 11 inches; the end connected with pump-plunger is 13 feet 11 ½ inches. The pump-plungers are 30 inches in diameter and have a stroke of 8 feet 9 inches, the displacement for each stroke

being nearly 321 gallons.

The maximum speed, pumping against a head of 166 feet in the stand-pipe, was about 11½ strokes or 100 feet

per minute when running a single engine.

The boilers are of the Cornish type, 6 feet in diameter and 30 feet long. The best duty these engines have ever shown is about 50 millions. Water was delivered to the reservoir through a 24-inch pumping-main about 2,200 feet long. From the reservoir to the central part of the city water was brought by a 20-inch pipe. This pipe furnished all the water used east of the rive until 1866.

The works as originally completed consisted of one pair of Cornish engines, having a daily capacity, when coupled together and run continuously at the greatest speed they cou'd attain when so coupled, of about 7½ million gallons. The pipe system, including three miles of mains from 16-inch to 24-inch, was only 13 miles, and one-half of the small pipe was 4-inch.

small pipe was 4-inch.

The number of stop-gates was 130 and of fire-hydrants

Water was taken from the lake at a point 300 feet from the shore and one mile west of the river and conveyed to the pumps through a brick aqueduct of oval form, 4x5 feet and about half a mile long. The works when completed according to the original design of the engineer, cost \$526,713. Mr. Scowden, in his final report to the Board of Trustees, says: "The capacity of these works to deof Trustees, says: The capacity of these works to de-liver water is greater than the originally estimated wants of the population the works were intended to supply, which was for 100,000. They are, however, capable of supplying at least 200,000 inhabitants with an abundance of water. By an enlargement of the main pump-barrel and plunger to each Cornish engine which was contemplated in the plans, the supply may be increased to almost an unlimited extent. No fear can be entertained that the unlimited extent. No fear can be entertained that the present water-works in the next fifty years will fail to yield a superabundant supply of water." In 1867, just eleven years after the completion of the original works, the average consumption of water per day was 1,908,000 gallons. Four years later the consumption had doubled, and the rate of annual increase had reached 25 per cent. In 1870 the work of building the lake tunnel was com-menced; the purpose of this was twofold—first, to secure a supply of water uncontaminated by the discharges from the river, which was then, as now, the outlet of many main sewers, as well as being the channel for conveying to the lake the refuse from the many oil-refineries and slaughter-houses situated along its banks and tributaries.
The second and equally important object was to secure an increased supply of water. It was found that during low stages of water in the lake that the quantity delivered to the pumps was not equal at times to the capacity of one engine, and the rapid rate of increase in demand admonished the board of the danger of a water famine in the near future unless the supply was increased. Chicago about this time had completed her first tunnel and investigations of the formation underlying the lake in front of us showed substantially the same kind of clay, and it was showed substantially the same kind of clay, and it was decided to adopt the plan so successfully carried out by our Western neighbor. Work was commenced in the latter part of August, 1869, and after battling with many difficulties a tunnel five feet in diameter and one and three-fourth miles long was completed and put in use about the 1st of March, 1874, at which time the daily average consumption had reached about 5½ million gallons with a maximum monthly use of 6% milmillion gallons with a maximum monthly use of 6.8 milmillion gailons with a maximum monthly use of of a millions. In July, 1874, just eighteen years after the original works were completed, a new pumping-engine of ten million gallons daily capacity was added to the plant that was to furnish all the water required for fifty years. Two years later another engine of the same size was added. Thus, in 1876, just twenty years from the date of the completion of the first plant, the machinery required for making

posed to be ample for fifty years.

The third new engine was added in 1882 and a fourth in 1884, leaving the pumping capacity at this time, exclusive of the original Cornish engine, forty millions, with two of the original Cornish engine, forty minions, with two fifteen million Knowles engines now in process of erection. These will doubtless be ready for service by July next, when the total capacity will be seventy million gallons

certain a supply of water in times of greatest demand was of a capacity more than three times greater than was sup-

Main pipes were, of course, necessary to take the water from these engines. For the supply of the east side of the river, one 16-inch, one 20-inch, and two 30-inch mains are in use, with one 30-inch for the supply of that part of the city west of the river. In crossing the river three wroughtiron pipes are used, two of them being 36 inches and one 33 inches in diameter. They are all half an inch thick, double riveted, and are from 220 to 270 feet in length and dip, by easy curves, about 25 feet below the water-line, trenches having been excavated in which to place them.

In 1882 twenty acres of land were purchased and appropriated, on which to build a reservoir for the supply of the lower and average elevations of the older portions of the city, and a lot on which to place buildings and machinery for elevating water to levels that could not be reached with a head suitable for the northern and western part of the Main pipes were, of course, necessary to take the water

At the same time another tract of ten acres was purchased, distant about 100 rods east of the city limits, on which to build a reservoir for a high-service system. The head of water in the low-service reservoir is 170 feet, head of water in the low-service reservoir is 170 teet, that in the higher one being 325 feet above Lake Erie, or a difference of 155 feet. The dividing line between the high and low service systems being fixed arbitrarily on the 120-foot contour line, giving a maximum head for the upper service of 205 feet, and a minimum head of twenty that the low service was made. The minimum head in the low service was made greater than in the upper one, for the reason that only 2 ery limited area is embraced within the 305-foot contour

The low-service, or what is designated Fairmount Res. ervoir (named from one of the streets passing it). consists of two distinct basins of unequal size, made to conform to the outline of the land. The capacity of the larger one is 47 millions and the smaller one 33 million gallons. The high-service reservoir covers nearly ten acres, and

has a storage capacity of about 38,000,000 gallons. Water the old Cornish engines that were removed from the lower pumping-station to a building erected for their receptor, at the lower reservoir. The main leading to the upper reservoir is thirty inches in diameter and 13,000 feet long. The total number of miles of pipe in the two systems on the first day of January last was 25134, of which fiften miles is in the high-service system. We have about 5,000 stop-gates in both systems, and 2,517 fire-hydrants.

The number of service connections at this time is about

25,000. We have in use 1,525 water meters and registers, and during last year the average quantity of water meas-

ured per day was nearly 5.500,000 gallons.

The total water pumped in 1887 reached a daily average of 22,250,000 gallons, while the average for the month of July was nearly 32,000,000. The minimum monthly average was in April, when the quantity was only 17,700,000

n the 24th of March last a contract was awarded for building an additional tunnel from the inlet crib to the building an additional tunnel from the inlet cub to the lower pumping-station. This tunnel will be 7 feet in diameter and 9,200 feet long, and is calculated to deliver 110,000,000 gallons per day with a head of 13½ feet on the suction-pipes. In estimating the delivery, due allowance was made for the inequalities of surface in the masonry as well as for the angles at the shafts. When this work is completed the daily delivering capacity of the two tunnels will be over 150,000,000 gallons.

two tunnels will be over 150,000,000 gallons.
[A map showing the relative position and area of the high and low-service districts was exhibited.]

DISCUSSION OF PAPER ON CLEVELAND WATER-WORKS.

In reply to various questions, Mr. Whitelaw stated that the present annual revenue from the water-works is about 400,000; that the population of Cleveland has increased from 17,500 in 1850 to 43,800 in 1860, 92,800 in 1870, 160,100 in 1880, and, by police census, 214,000 in 1886. The average daily consumption of water per capita is \$\phi\$ eatlons. The total cost of the water-works plant to date

is \$5,500,000.

The tunnel into the lake is through clay similar to that encountered by the Chicago tunnel. It is generally very hard and dry and traversed by fractures through which the water entering cut away the clay and brought quicksand into the tunnel. When this occurred a bulkhead was built across the heading and the tunnel was deflected around the bad ground. Several such curves made the tunnel the bad ground. pretty crooked.

At other points soft clay was encountered and shields pushed by hydraulic rams were used in the heading for about 130 feet.

The tunnel twice crossed old channels of the river, but experienced no difficulty from them.

experienced no difficulty from them.

The crib is pentagonal, about 90 feet across and 60 feet deep, built of pine timber strongly braced. The floor and sides were planked with oak and the lower 15 feet was calked. It was towed to place and loaded with stone; gates were then opened and it was sunk by the water immediately five vessels, stationed one on each side, disharded 1,000 tons more of stone into it, and this weight together with the action of storms, caused it to settle 15 feet in the clay. The crib is sunk in 38 feet of water and is protected with rip rap.

The water is admitted through free inlets 2½x5 feet, and on one occasion, in very cold weather, when the layish

and on one occasion, in very cold weather, when the lavish use of water, being wasted to prevent pipes from freezing, caused an unusual suction the openings were choked up for a number of hours by accumulated masses of snow and ice.

Since then boilers and double steam pipes have been provided to thaw away such obstructions if necessary

No straining has ever been attempted, but a trial is to be made of a system of vertical racks

When spring freshets occur while the lake is covered with ice, the river water is spread out to the crib, and on these rare occasions only, sewage matter is detected there.

Last July the collection was commenced on four lines, east and west of the crib, of water taken from points 4 feet below the surface and 5 feet above the bottom of the

Four stations were taken on each line, the first ½ mile from shore, and the rest at 1/2-mile intervals. The water was collected on the stormiest days, sealed up in glass-stoppered bottles and analyzed, and comparisons made with samples taken from the surface and a depth of 75 feet at a point 15 miles out from shore. The best samples were found on the west line at the outer station, but no difference were approximate at the outer station, but no difference were approximate at the outer station. ence was appreciable near the shore.

Digitized by GOGLE

^{*} Paper by John Whitelaw, Memb Am. Soc. C. E., Superintendent, read before the American Water-Works Association, at Cleveland, O., April, 1888.

Experiments were made last October on the use of oil for fuel for the boilers, and it was found that the cost of pumping 22,500,000 gallons of water with the use of coal was \$64.22, and with oil \$81.33 a difference of \$17.11 in favor of coal, the oil costing 134 cents per gallon. The water-work's secretary, Mr. W. A. Madison, supplemented the description with an explanation of the system by which the 25,000 accounts are kept and collected twice by which the 25,000 accounts are kept and confected twice a year with a force of only five regular office employees. All the accounts are entered in two books which are posted daily. A machine, stamping consecutive numbers up to one million, numbers every bill, stub and ledger account, and they are kept by this number only.

Suggestions as to Methods for an Approximate Determina-tion of the Yearly Rental Value of Fire Hydrants, as Connected with any System of Water-Works.*

THE popular notion among both engineers and laymen in relation to this subject seems to be, that the fair yearly rental value of a fire hydrant as connected with a particular system of water-works, is an indeterminate quantity. The great range of prices which obtains in the various towns

great range of prices which obtains in the various towns and cities of the country, varying as it does from \$15 to \$125, is probably the result of this popular belief.

After considerable reflection, I am clearly of the opinion that this popular conception is entirely inaccurate. This remark I regard as especially true in relation to all waterworks plants which have been intelligently constructed with a due regard to the relative requirements for domestic and fire uses

tic and fire uses.

Preliminary to the discussion of the proposed methods of determination, it may be premised, that this yearly rental value will vary with each plantand will also slightly vary with each series of years of greater or less length, dependent upon improvements and extensions made neces-sary by increased consumption of water and the growth of

business interests to be supplied and protected.

The principal elements which enter into the determination of this question of values are as tollows:

1. A knowledge of the relations which exist between the maximum amount of water provided, under the plan of Construction, for fire purposes, and the maximum amount provided for all other uses at the same moment. This determination of relations to be made not only as to the supply through the conduit, but also as to the distribution pipes through each street.

2. A knowledge of the relative amount of power required to furnish the maximum amounts of water for fire purposes and domestic uses, in the case of a pumping

system, or of head in case of a gravity supply.

3. A knowledge, in case a reservoir or stand-pipe is used, of the increase in capacity required, because of the fire protection.

A. A knowledge of the number, size and character of the fire-hydrants and their branches and the specials and gates used in the fire provision.

5. A knowledge of the annual cost of superintendence of and repairs of the fire hydrants.

The intelligent water-works engineer, when called upon to design a water-works system, after having determined the source of supply, proceeds to inaugurate a careful inquiry into the question of maximum volume of supply required. This latter determination, in view of the almost phen omenal rapidity in growth of many American towns, is very largely problematical and its value will largely depend upon the experience, intelligence and sound judgment of the engineer; and whether the determination proves a correct one or not, it must be made.

The usual method is by careful inquiry and examination of the location and its natural advantages for business expansi on to arrive at a judgment of the probable eventual population and the character of the business enterprises to be most largely instrumental in the growth of the town in

When the probable maximum population at the end of 30 to 50 years is settled upon, it is further assumed that a domestic supply of from 60 to 100 gallons per capita per day is a fair and conservative provision, and the total daily supply is then for convenience stated in gallons per

It is also probably safe to assume that one-half of said daily consumption will occur during eight hours. The whole system of pipeaze must be adjusted to this maximum rate of domestic consumption.

The next subject of inquiry is the maximum quantity of water per minute which must be supplied for fire protection, and under what head.

To properly sould the

To properly settle this question, a familiar knowledge of the character, number and situation of the manufacturing and other industries in the town is required, as on these depend the number, volume and power of fire-streams required 10r protection.

Having settled upon the maximum number and character of the fire-streams fairly required at any one time in any special locality and the resulting number of gallons of water per minute which will thus be used, this number of gallons per m inute required for domestic use during the eight hours of s supposed greatest consumption, will constitute a fair determination of the maximum number of gallons per minute and the maximum number of gallons per minute and the maximum number of gallons per minute of the maximum number of gallons per minute of the maximum number of gallons per minute of the maximum number of gallons per minute of the maximum number of gallons per minute of the maximum number of gallons per minute of the maximum number of gallons per minute of the maximum number of gallons per minute and the minute of the maximum number of gallons per minute and the minute of the maximum number of gallons per minute and the minute of the minut fair detern ination of the maximum number of gallons per minute which must be supplied through the conduit. A further determination must also be made of the probable population and resulting domestic consumption in the various squares and main avenues of the town. This population

*Paper by J. Nelson Tubbs, Memb. Amer. Water-Works Association, read before the American Water-Works Association at Cleveland, O., April, 1888.

amount added to the required fire protection consumption

as previously determined will also determine the size of the several distributing mains.

The foregoing data being at hand, let the sum of the following items represent the increased cost of the plant, its maintenance and operation because of the provision for

fire protection:

(a) The excess in cost of conduit because of the necessity of seeking more distant sources of supply at greater eleva-

(b) The excess in cost of conduit, to include fire provision, from the point where a collecting reservoir might be located if a domestic supply only was desired.

(c) The excess in cost of the stand-pipe or reservoir

because of the fire provision.

(d) The excess in cost of the distribution in the town

itself because of the fire provision.

(e) The excess in cost of the specials used in the mains for hydrant branch, connections, over the same length of straight pipe, also including increased cost of setting and jointing same.

(f) The whole cost of the hydrant branches and laying

(g) The excess in cost of all gates and their setting in consequence of the increased size of the mains for the fire provision.

(h) The cost of all fire-hydrants and their setting.
(r) The cost of the annual repairs of the fire-hydrants

(i) The cost of the annual repairs of the internyonality capitalized at 5 per cent.

(j) Two per cent. of the cost of the fire provision as determined by the summation of items (a) to (h) inclusive, to cover cost of care and management of the fire plant and

said 2 per cent. capitalized at 5 per cent.

(k) A sum, the accumulated interest of which, at 5 per per cent., will produce the cost of the fire provision in, say, 35 years, thus providing for its renewal at the end of that period
(1) The excess in cost in case of a pumping plant should

be included in the items (a) to (h) inclusive, and the yearly excess in cost of operation should be capitalized at 5 per

The annual interest on the gross-sum of these several items, calculated at such a rate as capitalists are willing to receive for money loaned on good water works securities in the particular locality in question, divided by the number of hydrants in use, may be said to approximately represent the yearly rental value of each of said hydrants.

When thus determined for a system of water-works in-telligently designed, the yearly rental value of a fire hydrant will change very slightly, so long as the domestic consumption, including waste, does not exceed the amount contemplated by the original plan of construction.

It is a fact, much to be regretted, however, that very many existing systems of water-supply have been designed by persons totally incompetent for such a duty, and many have been constructed on too small a pattern either because of a lack of means or the stupidity of the local management.

such cases, the works when first constructed and before the domestic consumption has become large, may and in most cases do furnish water for fire protection in suffi-cient quantity and under a sufficient head for all practical purposes, but as the domestic use, with its concomitant waste, increases, the volume and head for fire-streams diminishes year by year, until the only value the system has for the latter purpose is the possible furnishing of insufficient quantities of water to steam fire-engines at convenient points for use.

In cases of this kind a yearly determination of values

should be made and the methods modified to the following

Instead of seeking to determine the ultimate domestic consumption, the actual rate of such consumption at the date of the examination may be used until such time as the domestic uses have absorbed so much of the volume and head of water as to render necessary the intervention of steam fire-engines and other appliances to supplement the volume, power, and effectiveness of the streams at the hydrants, when some other method of determination will have to be adopted, the water-works having then assumed a value for the extinguishment of fires but little in excess

of the old street fire-cisterns or reservoirs.

When the works have reached this condition, there should arise but little controversy in relation to values, and a determined effort should be made for a reconstruction of the system under the advice of an engineer of judg-

ment and experience. One other modification of conditions may possibly be encountered in the experience of the engineer, and that is where, for some cause, the element of sufficient head for effective modern fire-streams has been deliberately neglected, but where an adequate volume for that purpose has been provided at each hydrant.

The writer can perceive no reason why the method of determination of the rental value hereinbefore indicated may not be applied in such a case.

If in the exercise of a wise discretion the engineer shall conclude that the mere furnishing of an abundant volume of water at each hydrant, leaving the head to be supplemented by other appliances, shall prove of sufficient value to compensate for the increased cost of the works because thereof, there can certainly be no good reason adduced to prevent the application of the foregoing methods for de-

In such a case we are justified in the assumption, that the supplementing of the head at the hydrant by other appliances, is cheaper than that of providing the head in the original plan of construction.

The writer has had occasion to use the foregoing described methods of determination in the settlement of a controversy between a water works company and the citizens of a flourishing manufacturing village in the State of New York, in which the yearly rental paid for each firehydrant had previously been \$50, but which by this method of determination was reduced to \$34.50.

The determination was finally accepted by both parties as a satisfactory solution of the problem of hydrant rental

This method had been applied and accepted in the granting of water-works franchises in other towns where the plans had been fully settled, also in the determination in my own city of the allowance which should be made to the water-works fund for public uses of water.

The method thus briefly stated is respectfully submitted

for the consideration and criticism of the members of the

That the foregoing method may be more readily followed and understood, I append the following illustration of its application to an assumed gravity supply,

tration of its application to an assumed gravity supply, the case being purely an ideal one:

Assume a village situated on practically level ground, with seven streets, each 100 feet wide, running north and south, and designated respectively, commencing with the most westerly, as A, B, C, D, E, F, and G Streets. Also six streets 100 feet wide running east and west, and designated respectively, commencing with the most northerly, as First, Second, Third, Fourth, Fifth, and Sixth Streets. These divide the village into thirty squares, the sides of each being 500 feet long.

each being 500 feet long.

It is further assumed that each square has, or will have, a population of 120, making a present or eventual total

Tris also assumed that at a distance of 5,000 feet north of the north line of the village a minimum supply of water equal to 375 gallons per minute may be collected directly into a reservoir at an elevation of 200 feet above the level or the town. Also that the same amount of water may be collected directly into a reservoir 125 feet high at a point 2,500 feet north of the north line of the village, or midway between the town and the reservoir as at first assumed.

Under these conditions what would be the fair yearly

rental value of each two-way fire-hydrant?

DETERMINATION

Making the maximum estimated requirement...... 1 275 gallons per minute.

The first assumed reservoir has an elevation of 200 feet plus the village, equal to a static pressure of 86.6 pounds To deliver at the north line of the village (a distance

from the reservoir of 5,000 feet) 1,275 gallons per minute through a 12-inch main, involves a friction loss of about 10 pounds per square inch, which deducted from the pressure, 86.6 pounds, due to the head of the reservoir, leaves a working pressure at the hydrants at the intersection of the conduit with First Street of 76.6 pounds per square inch.

As the longest line of rubber 2½-inch hose required to be used at this point (with 11/6-inch nozzle) need not exceed 300 feet, the friction loss in the hose would be exceed 300 teet, the friction loss in the hose would be about 29 pounds, which deducted from 76 pounds would leave an effective pressure at the nozzle of say 47 pounds, which would produce streams reaching about 120 feet horizontal and a vertical height of 90 feet.

Such streams would be regarded as sufficient for a town of the population assumed, and hence the size of the conduit may be fixed at 12 inches diameter.

The post questions to be determined are whether a

The next questions to be determined are, whether a reservoir placed at an elevation of 125 feet would be high enough for domestic use in case the fire provision is abandoned, and if so, what should be the size of the conduit?

The second reservoir is assumed to be placed at an ele-

The second reservoir is assumed to be placed at an elevation of 125 feet plus the village datum, equal to a static pressure of 54 pounds per square inch.

The friction loss in a 6-inch pipe, 2,500 feet long, discharging at the rate of 375 gallons per minute, is about 14 pounds, which, deducted from 54 pounds due to the elevation of the reservoir, would leave an effective pressure at First Street of 40 pounds, equal to 92 feet head, which would corry the water to the upper stories of all buildings. would carry the water to the upper stories of all buildings, if provided with service-pipes of reasonable size, and the conduit for a domestic supply may, therefore, be fixed at six inches diameter.

The excess in cost because of obtaining sufficient head for the fire service may be stated as follows and designated

Amount of Item (a)..... \$4.006

The excess in cost because of increased size of the conduit for the fire service from the second or lower reservoir town may be stated as follows, and designated as item (b):

Amount of item (b) \$2,138



The next question to be considered is to what extent the size and cost of the reservoir is to be affected by the addition of the fire provision.

tion of the fire provision.

In the case assumed, the minimum flow of the collected water is placed at 375 gallons per minute, while the average requirement for the whole twenty-four hours is at the rate of 250 gallons per minute. It follows that for the domestic supply only, a very small and comparatively cheap reservoir may be designed and safely employed, say with a capacity of 100,000 gallons or less.

The fire provision must, however, be provided from stored water, and the minimum amount thus stored must equal 900 gallons per minute during the continuance of a fire.

fire.

In a manufacturing town a single fire may require firestreams for a period of at least four hours, and it is not
unusual that three such fires should occur within a period
of twenty-four hours. This would require a storage as
follows: 900 gallons per minute for twelve hours or 720
minutes equals 680,000, say 700,000 gallons, to which add
100,000 gallons for domestic storage, and we reach the
conclusion that we require a reservoir of a storage capacity
of 800,000 gallons when we include the fire provision, as
against one of 100,000 gallons for the domestic system
alone.

The determination of the difference in cost of the two reservoirs is not difficult, and, therefore, for our present purpose we will assume the amount of this difference in cost and designate the same as item (c).

We will now proceed to the determination of the increased size and consequent cost of the pipe distribution because of the fire provision; and to illustrate will take the case of the main in First Street, or the most northerly street in the village, and which is 3,700 feet long and intersects the conduit at "D" Street.

At the north-west corner of the village at the west end of First Street, and at a distance of 1,850 feet from the intersection with the conduit at "D" Street, it is required to furnish as follows:

to furnish as follows:

The friction loss in a 10-inch pipe, 1,850 feet long, under these conditions is about $5\frac{7}{10}$ pounds, which will give practically the same character of fire streams as at corner of D' Street, where the 12-inch conduit for the stream and the same character of the stream and the same character of the stream and the same character of the stream and the same character of the stream and the same character of the stream and the same character of the stream and the same character of the same character o "D" Street, where the 12-inch canduit first reaches the north line of the town, especially so in case any less than six streams should be used at once.

By a similar calculation we might determine the size of main required for each of the two systems.

We will assume for the use of brevity that this has been done with the following results:

Sizes of Mains Required for the System including the Fire Provision.

Sizes of Main's Required for the Domestic Supply Alone.

On making the necessary combinations, we find that the distribution which provides a fire protection will require a weight of straight pipe 236 net tons in excess of the domestic system, and about 6,000 pounds of special castings. A detailed calculation will also show that the laying, jointing, etc., of the first system will cost about \$900 in excess of the second.

The following statement includes these several includes

The following statement includes these several items, and indicates the excess in cost of the village distribution because of the fire provision, and may be designated as

Estimate.

The assumption is made that the town in question will require fifty fire-hydrants, and Item (e) will represent the excess in cost of hydrant branch specials and cost of jointing, etc., over the same length of straight pipe.

Estimate,

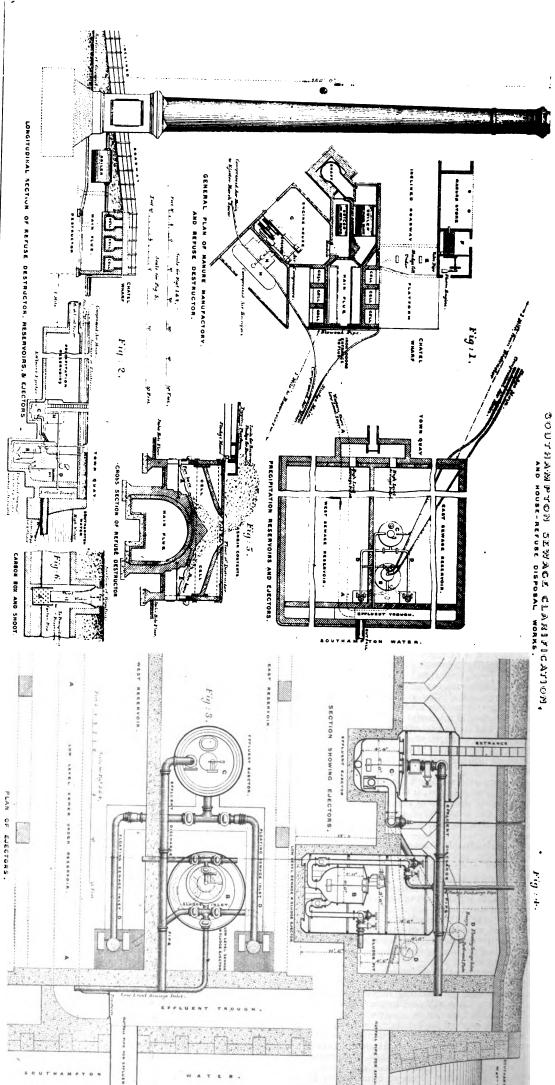
10,7to pounds specials for hydrant branches, at 3 cents.. \$321 Extra cost of setting, jointing, etc., over straight pipe.. 100 Deduct.

4,000 pounds straight pipe saved, at 1.7 cents...... \$68

Item (f) includes whole cost of hydrant branches and laying same.

Amount of Item (t) \$600

Item (g) embraces the increased cost of valves required in consequence of the increase in the size of the distribution mains required for the fire provision. As these can



Cost per day.

easily be exactly determined, I simply assume an amount for my purpose of illustration.

Excess in cost of gates and setting, Item (g)\$500

Item (h) includes the cost of all fire-hydrants and

Estimate.

50 two-way fire-hydrants, at \$30 50 setting fire-hydrants, at \$4	
Amount of Item (h)	<u> </u>
Amount of Item (n)	#1. /00

Summation of Preceding Items Comprising Cost of Fire Provision.

1,00.300	
Item (a)	\$4,096
Item (b)	2,138
Item (c)	
Item d)	9,104
ltem 'e)	353
Item (t)	600
Item (g)	500
ltem h)	1.700
Cost of the fire provision. Item (i) is the capitalization of the yearly cost of repairs of fire hydrants as follows, so hydrants at \$3 = \$150 + 5 cents = . Item (j) is the capitalization of the yearly cost of care and management of the fire plant, as follows: The cost of plant = \$21,001 × 2 per cent = \$439.82 + 5 cents . Item (k) is a sum, the accumulated interest of which, when compounded at 4 per cent, will in 35 years amount to the cost of the fire provision plant and also repay the original sum at the end of the period, as follows:	3,000 8,796
Formula $S = \frac{x}{1.04 n - 1} \times P$. In which $S = sum$	

which will at end of 35 years at 4 per cent. produce (S + P).

P = original cost of fire plant.

n = number of years in which plant is to be renewed.

As water-works bonds can readily be sold at from 31/4 to 5 per cent. using the larger rate we have \$41,252 \times 5 per cent = \$2,062 60 yearly interest on same, which must be paid from fire hydrant rental.

\$2,062.60 + 50 hydrants equals \$41.25 per year as the rental value of each hydrant in the case assumed.

DISCUSSION OF PAPER ON RENTAL VALUES OF FIRE-HYDRANTS.

Q. Is provision made in this system for extension of the fire-service?

A. Yes; but occasional readjustment is required.
Q. Is the storage capacity sufficient? I know of a sim-

sized village where a recent fire required 2,000,000 gallons of water.

A. The case in the paper is an assumed one, and the matter is entirely one for the designer's judgment. In Rochester we have 1,700 hydrants, for which we are paid about \$50each. For this and other public service we receive from the city an annual credit of \$100,000.

One member thought that consideration should be given in such estimates to the element of uncertainty of the amount of water required, and danger to pumps from sud-

den demands for fire-service.

Another member thought the best way out of the dilemma is to get a round sum per mile from the city, and then permit them to use as many hydrants as they wished

SOUTHAMPTION SEWAGE - CLARIFICATION AND HOUSE-REFUSE DISPOSAL WORKS.*

THE author was instructed, by the Corporation of Southampton, to devise a scheme for the clarification of the sewage of a part of the borough, which was discharged into Southampton Water at the Town Quay, and also for the more efficient collection and disposal of the house refuse of the whole town. He accordingly proposed the adoption of Messrs. Manlove, Alliott, Fryer & Co.'s refuse-destructor, to serve the double purpose of destroying the ash-bin contents and garbage and of disposing of the sewage-sludge deposited, in the process of clarification, in two existing reservoirs adapted for the purpose (Figs 1 and 2). Formerly the sewage of a district of the town, amounting to 500,000 gallons in twenty-four hours, from a population of about thirteen thousand, for the most part flowed by gravitation into these reservoirs, from whence it was discharged into the tideway at low water; whilst a small portion, coming from a low-level sewer, passed through iron pipes A A, laid under the reservoirs, direct into the tideway (Fig. 1). The reservoirs act alternately, one being left still for the precipitation of the sewage, whilst the other is being filled.

In order to render the discharge of the effluent from the reservoirs independent of the tide, and to raise the lowlevel sewage into the reservoirs for treatment with the rest. two of Shone's pneumatic ejectors were put down (Figs. 3 and 4), one of 360 gallons capacity, B, placed below the invert of the low-level sewer, which serves for discharging

the sludge as well as for raising the low-level sewage, and the other of 700 gallons capacity placed in the east reservoir at C (Figs. 1 and 2). In each reservoir there is a floating sewage inlet, D D, consisting of a pipe connected with the large ejector, and shackled to a buoy which makes the pipe rise and fall with the water level, keeping its mouth, which is covered with a perforated plate, a few inches below the surface of the effluent, to prevent the passage of any floating matter (Figs. 3 and 4). Directly the clarification by precipitation has been effected to a certain depth, a valve is opened, admitting the effluent into the ejector C, whence it is at once discharged into the tideway. A supplementary sewage outlet is also provided in each reservoir for discharging the effluent by gravitation when the tide is low enough. When the whole of the effluent has been thus drawn off, the buoy, resting now upon the floor of the reservoir, keeps the mouth of the inlet sufficiently high to prevent the admission of any sludge; and the sludge is then admitted into the ejector B by opening a valve, and is transmitted by pneumatic force through a line of 4-inch cast-iron pipes, nearly a mile in length, to the destructor erected on the Chapel Wharf (Figs. I and 2).

The sludge is discharged into a cell, E, from whence it is drawn as required through a valve-pipe, and, after mixture with road-sweepings in an incorporator, F. driven by a small steam-engine, is turned out as a good, dry portable manure, which has all been readily bought up by agriculturists, since the commencement of the works, at 2s. 6d. per load delivered at the works. On an average, seventy cart-loads of ash-bin contents are daily collected and destroyed, a small portion only being occasionally sold; and twenty-five tons of refuse, when burnt, generate sufficient steam for the carrying on of the works for one day, being about a fourth of the refuse collected in the borcugh, including the roadsweepings which are never burnt. In wet weather, the road-sweepings are stored and dried; and the fine ashes from the destructor are incorporated with the sludge in their place.

The refuse destructor has six cells or furnaces, each capable of burning 8 to 9 tons of garbage per day (Figs. 1, 2 and 5). The products of combustion pass through a 30horse power multitubular steel boiler, in the main flue, to the furnace-shaft. There is also a bye-pass in which a smaller boiler is placed, to enable the works to be continued during cleaning and repairs. No obnoxious fumes from the combustion have been perceived. The steam generated in the boiler is employed for driving the engines G, of 31.5 indicated horse-power, which compress air into two large receivers H H, whence it passes in a 5-inch main to the Town Quay, where it is automatically supplied to the ejectors when required for working them; and it also reserves for driving the precipitated sludge through the main to the destructor, before referred to, being led from the receiver by a pipe to the head of the main at the Town Quay.

All obnoxious matters are collected throughout the borough in specially constructed, covered, iron tumblercarts, which go up the inclined roadway approach to the destructor, and discharge their contents direct into the cells. The road-sweepings are discharged into a hopper over the incorporator, and, after passing over a rocking screen, are mixed with the sludge as required.

The residue from the continuous day and night combustion consists of about twenty per cent, of good hard clinkers and sharp fine ashes: the clinkers are used for the foundation of roadways and the manufacture of pavingslabs: the fine ashes are employed for mortar, as well as in the preparation of sludge for manure. Porous carbon is used for precipitating the sludge; it is mixed, with one pound of sulphuric acid per hundred weight and clean water, into a stiff paste, and led through a shoot, I, into a box, J, with perforated sides, placed in the sewer, Fig. 6. The sewage flowing past washes the carbon gradually out of the box, and is thoroughly mixed with the carbon by the time it discharges into the reservoirs at a manhole 150 feet off. A small stream of water falling down on the carbon prevents its consolidating. The box is filled three times in twenty-four hours; and this method of dosing the sewage has proved quite efficient and satisfactory.

A pressure of air of 40 pounds on the square inch is required for working the sludge-ejector and 10 pounds for the effluent-ejector. Eight tons of sludge are dealt with per day; and arrangements were provided for burning the sludge. The sludge was discharged into a tank on the

floor of the destructor, and drawn out through ports in the front opposite the feed-openings of the cells, where its moisture was absorbed by the ash-bin contents, backed up against the ports with this object; and the mixture was then raked into the fires (Fig. 5). Large quantities of sludge have thus been destroyed; but the process has been discontinued owing to the ready sale of the sludge when prepared for manure.

Working expenses and number of men employed upon the Southampton Sewage-Clarification Works.

Materials-Carbon, 10s. 5d.; sulphuric acid, 3d.; carriage, 2d. o 10 10 £1 5 4 The annual cost per head of the population (13,000) served by the sewage-clarification works 15... o
By receipts from sale of manure for the year...402
Average per day ... 1
On account of the returns from the sale of manure the s.wage-clarification makes but a trifling difference in the s wage rate. HOUSE-REFUSE DISPOSAL WORKS.

THE PLANT OF THE BOSTON HEATING COM-PANY.

No. I.

As most of our readers are aware, pipes for the circulation of superheated water for heating and power purposes have recently been laid in a portion of the city of Boston, and believing that this use of hot water by such novel methods and on so large a scale cannot fail to be of interest, we give the following illustrated description taken from a paper read by Mr. A. V. Abbot, Chief Engineer of the National Superheated Water Co. of New York, before the Boston Society of Civil Engineers, November 16, 1887.

We are also indebted to Mr. Abbot for the electrotypes of the accompanying illustrations, of which one herewith given is a general view of the arrangement and application of the system, and the other is a map of the district in which pipes have been laid.

The object of a heating system is to distribute heat from place to place; and whatever means are used to carry heat from point to point are simply auxiliary, the distribution being the end to be accomplished.

Before proceeding further we must establish some standard by means of which heat can be measured. The unit that is adopted in this country is the quantity necessary to raise a pound of water one degree. With it we can express quantities in the terms of that measure-for example, 1,000 units of heat is the quantity necessary either to raise one pound of water 1,000° or 1,000 pounds of water one degree.

To carry any substance from one point to another we wish to select for our means of transportation that arrangement which will enable us to convey the greatest amount for the least expenditure. Take the following example:

If a range is to be maintained at a temperature of 250°. it is proposed to supply water at 400°. Suppose there is introduced into the range a cubic foot of water at 400°, the weight of the cubic foot of water is 53.63 pounds. If the temperature of the range is to be kept at 350° the water can only be allowed to fall to 350°. The fall in temperature is therefore 50°. The whole quantity of heat liberated by the fall of the temperature of the water is 53.63x50x1.0174.* or 2,728 heat-units.

The vehicle which is most commonly used instead of water for the transportation of heat is steam. Supposing, instead of admitting to the vessel a cubic foot of water, we admit therein a cubic foot of steam at the same temperature of 400°. Now if that steam falls from 400° to 350°, a portion of the steam is condensed and the latent heat liberated. A cubic foot of steam at 400° weighs 0.547 pounds, and at 350° it weighs 0.3056 pounds; the difference between the two is 0.24 pounds. The latent heat of evaporation of steam at 400° is about 830 units per pound; therefore by multiplying 830 by 0.24 we obtain a product of 199.2 as the number of heat-units set free by the fall in temperature of a cubic foot of steam from 400° to 350°. It has been seen that the cubic foot of water will deliver 2,728 units of heat, while the

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^{*}Paper read before the Institution of Civil Engineers by William Benjamin George Bennett, Assoc. Mem. Inst. C. E. The illustraions are from drawings made by the author.

^{*} The additional .0174 is due to a very slight increase in the specific heat of water as the temperature rises.

cubic foot of steam yields 199. The ratio of these two quantities is 13.7 to 1. Hence it is obvious that 13.7 cubic feet of steam must be circulated to do the same amount of heating as may be accomplished by one cubic foot of water. Just as soon as the steam has fallen to the temperature at which it is required to maintain the range, the steam must then be exhausted to give place to a new supply.

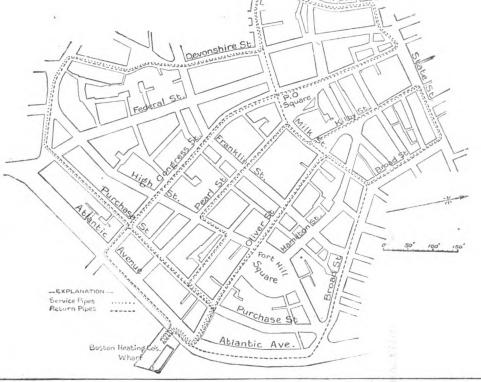
It is true that steam, being a light, aeriform fluid, will flow through pipes much more easily than water will. By the well-known laws of hydraulics the relative velocities at which fluids travel through pipes vary inversely as the square roots of the densities. The square roots of the densities of steam and water are as I to 9.87. Consequently, under the same conditions, with the same length of pipes, the same resistances in the pipe, and the same pressure on the circulating medium, 9.87 cubic feet of

steam would flow to one cubic foot of water. But for equal volumes the water is to the steam, as far as heat carrying power is concerned, as 13.57 to 1, whereas the relative volumes which would be transmitted through a pipe under the same conditions are as I to 9.87. The expense of delivering to a distant point any fluid depends simply upon the amount of mechanical work necessary to overcome the resistance of the pipe. velocities at which water and steam will flow under the same conditions are as 1 to 9.87; but the relative volumes necessary to deliver the same quantity of heat are as I to 13.7; hence the current of steam must must have a velocity 1.35 times greater than would be given it by the pressure necessary for the water-current. Remember that the velocity of transmission through a pipe is not a question of weight, but a question of volume. A 4-inch pipe will, at the same velocity, carry no more cubic feet

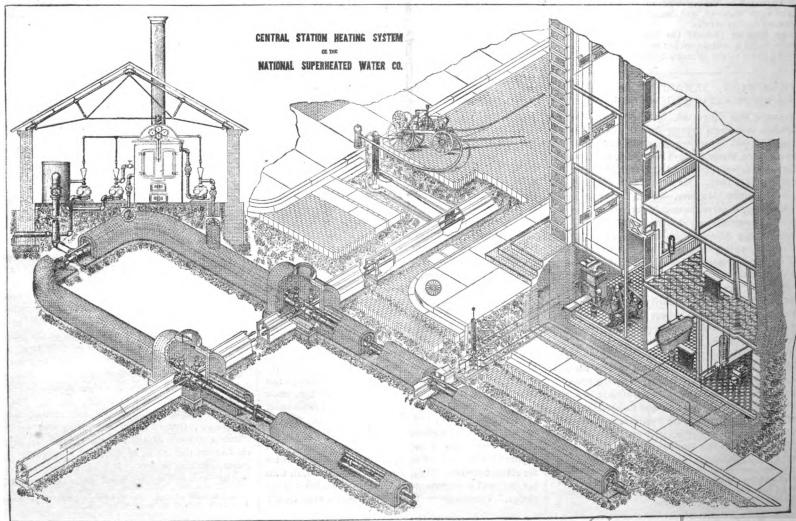
of mercury than it will of hydrogen gas, although the density of the mercury is several thousand times that of the hydrogen. It will carry more pounds of mercury, but no more cubic feet. So to deliver equal quantities of heat there must be in the case of steam a velocity of 13.7 times that of the water. The mechanical work, which is the measure of the expense of transportation of a fluid, varies as the cube of the velocity at which the fluid flows. We have seen that, under similar circumstances, if the velocity of the water-current is 1, the velocity of the steam-current to transport an equal amount of heat, must be 1.35 times as great as would be given by the amount of mechanical work that would be sufficient to give the required velocity to the water. Cubing, it is obvious that

required velocity to the water. Cubing, it is obvious that the relative expense of transporting equal quantities of heat, by steam or water, will be about as I to 2½.

It is usually assumed that a current of steam flowing through a pipe is maintained by the expansive force of the steam itself. Precisely: but this expansive force in the steam is only attained by a fall in pressure and temperature, and, consequently, by a corresponding amount of condensation. Returning to our former example, if, at the end of a long pipe, it is wished to deliver steam at 400°, corresponding to a pressure of 250 pounds to the 400°, corresponding to a pressure of 250 pounds to the square inch, it would be necessary at the central station to put upon the boilers a sufficient pressure in addition to that at which it is expected to deliver steam to overcome the inevitable friction of the pipe between the boilers and the place where the steam is to be delivered. In a long line this friction is of considerable amount, so that in order to accomplish the necessary delivery of steam the boilers would be called upon to bear a burden equal to the amount of radiation of the line plus the amount of the amount of radiation of the line plus the amount of frictional resistance offered to the steam-current. The frictional resistance may, of course, be reduced to a minimum by the use in the line of pipes of very large diameter. This has frequently been done with the inevitable result of very largely enhancing the cost of the plant and increasing the difficulties both of construction and of maintenance. In the case of the water plant, it is only necessary to subject the boilers to the pressure requisite to give the temperature at which it is wished to deliver the water plus the much smaller amount of radiation which takes plus the much smaller amount of radiation which takes place from a pipe of less diameter than that employed in the steam plant, the frictional resistance of the pipe the steam plant, the frictional resistance of the pipe being entirely overcome by means of a forced circulation obtained by pumps. The boilers, which perhaps are being entirely overcome by means of a forced circulation obtained by pumps. The boilers, which perhaps are the most difficult part of the system, are much more easily constructed and maintained. Thus, by means of the use of an incompressible fluid like water, and the employment of a pump to produce circulation, a much higher initial pressure can be placed upon the pipe line to overcome the frictional resistances of the pipe. This enables us to employ a very much smaller pipe than is customary to use in steam plants, and largely decreases the expense of the system and the difficulties of construction and maintenance.



(To BE CONTINUED.)



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DOMESTIC ENGINEERING, ETC., IN THE CEN-TRAL TRUST COMPANY'S BUILDING, NEW YORK CITY.

No. I.

TANK SYSTEM.

In the recently completed building of the Central Trust Co., of New York, there are a number of interesting features in the plumbing, the most prominent of which it is proposed to describe in successive articles.

The architect was Mr. Charles W. Clinton; the master plumber was Mr. John Toumey.

The water-supply of this building is under three divisions-viz., for the steam-engines, for domestic purposes, and for the elevators.

volume of confined air becomes too great, a rod is inserted through P, and, pushing up the ball, allows its escape. Inside the tank a float, H, is attached to the lever I, which is fixed at J to the shaft of pulley K, around whose face a steel wire, L, is wrapped, and thence led to the mechanism of gauge, M, whose index gives the height of water in the tank, which is also transmitted by electricity, over the wires O O to an annunciator in the engine-room. A direct column gauge, Q, is also attached to other end of the tank (see Fig. 2).

Figure 3 shows the tank for domestic supply. It is about six feet high and eight feet square, and was built, in its present position, of ¼-inch iron plates. N is the 21/2-inch feed-pipe, A the 3-inch fire-supply, and B and C are 2½-inch supplies for the upper and lower parts of the building. D is a supply to janitor's rooms, branched with pipe E to water-closet. G and F are relief pipes from house and fire supply respectively, and simply open into the top of the tank. B is for house supply and C is for emptying tank. I is a large copper float, which rises and falls on guide-rods J J, and, by the steel wire K K, operates the gauge needle in the engine-room and indicates the height of water in the tank. The tank is set in

mains in street to supply stores, residences, etc.? If not. mains in street to supply stores, residences, etc. r 11 not, would you inform me your best method for constructing one? Our city is considering the question of laying a plant (or rather our electric light company is), and I would be pleased to receive your valued idea in your next issue.

Yours respectfully, SAMUEL C. TURNER.

[In Vol. VII. we published an illustrated account of the New York Steam Company's plant of this city, and on April 7 commenced an illustrated description of their latest and most complete steam-station. We shall describe in this and succeeding issues the hot-water plant now in use in Boston and constructed by the Boston Heating Company.]

SIZE OF TRAP-VENT PIPE.

CORNING, N. Y., March 30, 1888.

Sir: Please inform me early, through your journal or otherwise, what size pipe you would recommend to ventilate a trap made of 1½-inch pipe; or, in other words, about how much smaller can the ventilating-pipe be than the trap pipe to prevent its syphoning?

Very respectfully yours,

C. E. CORBIN.

[The size depends on the distance the vent-pipe has to go to reach air. We should advise using 11/4-inch pipe.]

AMOUNT OF COAL REQUIRED TO HEAT WATER FROM 40° TO 200°.

Togus, ME., April 12, 1888.

SIR: Will you kindly inform me how many pounds of coal would be required to heat water from 40° up to 190° or 200°?

Boilers are evaporating eight pounds of water to one

pound of coal, and the desire is to apply steam, at forty pounds pressure, to heating water, passing it through a brass coil in a hot-water boiler, the water of condensation

The amount to be heated to 190° or 200° is about 300 gallons per hour (average), or 7,200 gallons in twenty-four hours, and the question is, How much will it cost per gallon to heat it?

An answer at your early convenience will much oblige.
Yours, very truly, Engineer.

[To warm one pound of water from 40° to 200° Fah. will require 160 heat-units, and, as 300 gallons of water at 40° Fah. weigh very nearly 2,500 pounds, it is evident that it will require 400,000 heat-units per hour to be taken in form of steam from the boilers. This is the equivalent of 440 pounds weight of steam per hour at 40 pounds pressure condensed to water at the same temperature, and i cooled to the atmospheric pressure and temperature will require about 410 pounds weight. Then, if you get 8 pounds weight of steam per pound of coal, it is plain it will cost you the value of 55 pounds per hour to warm the water (300 gallons); or, in other words, 5½ gallons o water can be warmed by I pound of coal in the case you cite.]

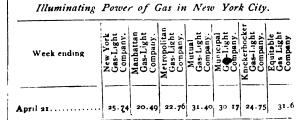
CAUSE OF CORROSION IN HOT-WATER RE-TURN-PIPE.

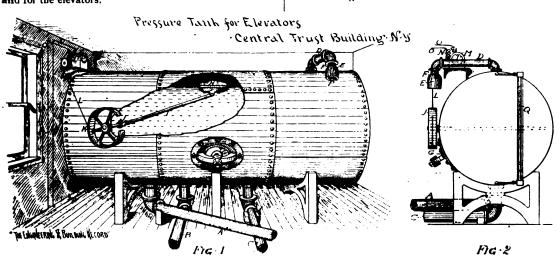
ISLE OF WIGHT, ENGLAND, March 6, 1888.

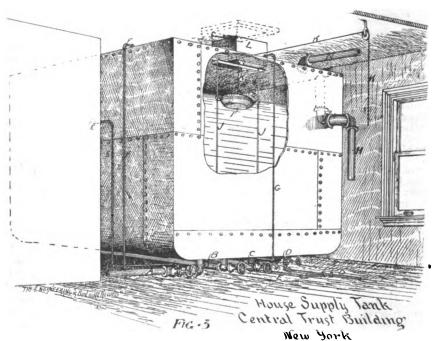
Six: If not troubling you too much, perhaps you could enlighten me through the columns of your valuable journal as to the following: On taking out a piece of pipe in a return (or circulating-pipe) I found the waterway almost completely stopped with iron rust, which led me to recommend the pulling out of the whole system of piping, and, on pulling it out, I found the whole of the return (circuting-pipe) corroded, but the flow (hot water) comparatively clear. What I want to know (putting aside the system clear. What I want to know (putting aside the system, which is one I should not recommend) is, why should one pipe be so much more corroded than the other? I have sent you rough sketch of piping and system to show connections to water-back, which was until recently connected as shown in Fig. 2. Yours respectfully, PLUMBER.

[You do not give us sufficient data to enable us to form a definite opinion. If the tank is of iron, we can readily see how the scales, sediment, etc., would settle into the return-pipe and stop it, as your sketch shows it coming out of the bottom of the tank.]

Gas and Electricity.







A 3-inch connection with the street-mains is branched to supply storage-tanks for each of the three systems. The engine tank is an open one, situated in the basement, and presents no features of especial interest. The other two tanks are in the upper story, and are illustrated by the accompanying sketches.

The pressure tank for elevator service, which was constructed by Otis Bros and Co. (Figs. 1 and 2), is a boiler-shaped cylinder, six feet in diameter and fourteen feet long, and was built in position of iron 3/8-inch plates, and is designed for a working pressure of eighty pounds per square inch. It is connected with 6-inch feed-pipe A and the 5-inch pipes B and C, which respectively supply the regular and the emergency cylinders.

The pipe D opens freely into the boiler, and carries at the opposite end a valve chamber, F, in which a rubber ball, E, rests loosely on the valve-seat, and is forced down tight upon it by the pressure in the tank. Whenever the a safe of a inch iron. There are two of these, one to indicate the level of water in the tank, and one to control the pump.

L is a well and M its trap-door, giving access from the roof to the interior of the tank. The tank is supported on rolled-iron beams. After the construction of this tank it was found inadequate, and another was built on the roof to supplement it.

(TO BE CONTINUED.)

Correspondence.

STEAM AND HOT WATER HEATING PLANTS FOR CITIES.

CHESTER, PA., April 21, 1888.

SIR: Would you please inform me if you have ever shown in your paper a diagram of a steam-plant such as are now being constructed in different cities by tapping

RATIO OF HEIGHT OF CHIMNEY TO RATE OF COMBUSTION.

THE height of a chimney depends a good deal upon the surrounding conditions. When there are no obstructions, like very high buildings or hillsides, Professor Thurston's approximate rule is very convenient. It is to add one to the pounds of coal burned per square foot of grate per hour, divide this by two and square the quotient. The result is the height of the chimnery in feet. If the rate of coal consumption is fifteen pounds per square foot of grate per hour, then the height would be

$$\left(\frac{15\times 1}{2}\right)^2 = 64 \text{ feet.}$$

From this it will be seen that the rate of combustion varies very nearly as the square root of the height of the chimney.

To find the diameter of a round stack equal in area to the flues in the boiler, Wood and Iron gives this rule: Multiply the diameter of one flue, supposing they are all of the same size, by the square root of the number of flues, and the product will be the required diameter of the equivalent round stack.

PUBLIC LIGHTING OF NEW YORK.

THE report for 1887 of S. McCormick, Superintendent of Lamps and Gas in the City of New York, shows that during the year 1,017 new gas-lamps have been lit and 151 electric lights, the average number of lights of both kinds during the year being 25,471. Nearly 102 miles of gas-mains were laid, of which two-thirds were laid by the Standard Gas Co. Altogether 1,119 miles of gas-mains are in use, of which 1,023 are on Manhattan Island. The Equitable Gas-Light Co. pays the city twenty cents per foot for every foot of main it lays, which since 1883 has amounted to \$97,852.40. No other company pays any-

Fourteen miles of new streets were lit, making an aggregate length of 478 miles of lighted streets. To this must be added 14 miles of piers and nearly 134 miles of bridges, with 62 acres of parks and 234 acres of market; 342/3 miles of streets are lit by electricity, and the total mileage lit, and under contract to be lit, by electricity is 673/4.

The contract prices for street lighting per annum, including gas, lighting and extinguishing, vary from \$12 to \$29 per lamp, and for electric lighting per light per night from 19.9 to 60 cents. Gas of 18 and 28 candle-power has been contracted for at \$1.25 per 1,000 cubic feet.

The average pressures per quarter have varied from 3.07 inches of water to 0.93 inches.

ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting was held in the club room April 16. The president reported in brief what action had been taken by the delegates at Washington respecting the Cullom bill, stating that there would be no difficulty in its passage by the Senate, while in the House, though there was not the same unity of feeling, no great opposition was looked

for.

Resignation of Mr. George C. Stealy was accepted.

The discussion of Professor Waddell's pamphlet, began in the last regular meeting, was then continued as follows:

A paper was read by Mr. W. H. Breithaupt; the secretary read contributions from Professor De Volsen Wood, Messrs. read contributions from Professor De Volsen Wood, Messrs. Samuel G. Artingstall and Edwin Thatcher, Professor P. C. Ricketts and Mr. W. L. Cowles. These were discussed by Messrs. Goldwark, Wynne and Breithaupt, and replied to by Professor Waddell.

Mr. Chanute then presented the following resolutions, which were adopted by the club:

"First.—That a committee of three be appointed by the president to prepare and submit to this club a form of memorial to the Legislature of this State, together with a draft of a law inaugurating a proper inspection of bridge and that for this purpose the committee may consult with

public spirited counsel.
"Second.—That the secretary be instructed to notify

other engineering societies and clubs throughout this country of the action taken by the club, and to solicit their co-operation in this movement.
"Third.—That in case of the appointment of similar

or Third.—That in case of the appointment of similar committees by other clubs, the committee of this club be instructed to confer and co-operate with them in drafting the project for the proposed law, and in drawing up general specifications and rules to guide the State inspector."

Mr. Chanute mentioned the following means as proposed for effecting the desired reform: (1) The employment of expert engineers; (2) The use of legal standards of strength, as was once recommended by the American Society of Civil Engineers; (2) The formation of a pool of re-

ciety of Civil Engineers; (3) The formation of a pool of responsible bridge builders as outlined in Prof. Waddell's pamphlet; (4) State inspection, as now in use in Massa-chusetts and New York. The latter was generally considered the most feasible.

Mr. Wynne thought expense in the latter case might be avoided by inspecting the existing bridges as opportunity occurs, keeping on hand a force simply sufficient to report on new work

on new work.

On vote of the club the above resolutions were adopted, amended by the substitution of "Executive Committee" for the word "Club" in the first clause.

The chair appointed as members of the committe proposed Messrs. Chanute, Waddell, and Breithaupt.

Adjourned.

ENGINEERS' CLUB OF PHILADELPHIA.

THE regular meeting was held April 7, Vice-President John T. Boyd in the chair, Howard Murphy, Secretary; thirty-nine members and one visitor present.

The Secretary presented, for Mr. Frederic H. Robinson, a description of the electric street-railway at Wilmington,

Del.
Mr. William H. Robinson presented an illustrated Mr. William 11. Robinson presented an illustrated paper upon "Rope or Cable as a Transmitter of Power."

The Secretary presented, for Mr. C. A. Preston, a description of the effect of gases, etc., from stacks upon iron, illustrated by a drawing of the Charles Street Bridge over the N. C. Railway tracks at Union Station, Baltimore, Md., and by a very complete and interesting set of specimens of iron from the bridge.

Mr. Herbert Bamber presented notes upon two experi-

Mr. Herbert Bamber presented notes upon two experi-

Mr. Herbert Bamber presented notes upon two experiments with cement mortar.

Mr. Howard Murphy presented a diagram showing the results of Watertown Arsenal tests of the crushing strength of Potomac red sandstone and other building stones, bricks and brick masonry. The diagram shows the following:

No.	MATERIAL	Crushing St pounds per s	
Tests.	TATERIAL.	From	To
6	Lee, Mass., marble	20,504	22,900
10	Potomac red sandstone	16,625	22,102
2	Conshohocken, Pa., limestone	14,090	16.340
6	Montgomery Co., Pa., blue marble	12,810	13,610
	Philadelphia pressed bricks	9,590	13,700
3	r miadelphia pressed bricks	7,210	9,050
4	Indiana limestone	7,190	10 620
11	Philaderphia hard bricks	5,540	20,830
10	Ohio sandstone	3,940	16,280
6 6	Philadelphia brick masoniy in cement mortar	1,600	2,685
	mortar	799	1,914

He also noted the other qualities of the Potomac red sandstone, which are of special value to the engineer in construction—its durability under the action of frost, fire and wear, and its resistance to dampness.

Mr. Edward Hurst Brown mentioned that the reason the Potomac red sandstone was not more used for architectural purposes was that, while of a beautiful color, owing to its extreme hardness it was very difficult to dress, and to its extreme hardness it was very difficult to dress, and also that very often in an apparently perfect stone a flaw world develop in dressing the face which would render it useless for facing stone. He also mentioned having seen at Brentsville, Prince William Co., Va., an old church built of practically the same stone, taken from the neighboring Bristow Quarry, which had stood for over one hundred years, exposed to war and the elements, and which showed no signs of defects due to frost or action of the weather. weather.

A communication by Mr. G. Y. Wisner, C. E., for years connected with the Lake Survey, entitled "The Physical Phenomena of Lake Harbors," was submitted by title. It shows that the progressive movement of sandy spits is attributable to the resultant waves and currents produced by the periodic oscillations of the lake surface, and that the effects are a produced by the periodic socillations of the lake surface, and that the effects are similar to those produced by the flood-tide on the Atlantic Coast, as explained by Professor L. M. Haupt in his paper on the "Physical Phenomena of Har-

ENGINEERS' CLUB OF ST. LOUIS.

THE meeting was held April 18, 1888, President Holman in the chair, twenty-seven members and two visitors present. W. H. Bryan, secretary. John H. Mueller and Charles W. Stagl were elected members.

A communication from the Council of Engineering Societies on the Reorganization of National Public Works was considered.

was considered. Prof. Johnson moved the reappoint-ment of a committee on national public works. Seconded. A general discussion followed, participated in by Messrs, Johnson, Seddon, Engler, Bryan, Nipher, Burnet, Russell, and Blaisdell. Mr. Seddon moved as a substitute sell, and Blaisdell. Mr. Seddon moved as a substitute that the matter be referred to a committee of three, to report not later than May 16, which was carried. The chair appointed as such committee F. E. Nipher, S. B. Russell, and A. W. Hubbard. Mr. S. Bent Russell then read a paper on "Thickness of Water-Pipe, with Some Experiments on Ram." His remarks were illustrated by a number of charts, tables and formulæ. He showed that great discrepancies existed between standard authorities on the question of thickness of pipe. In general the thickness of the smaller sizes is fixed by questions of manufacture and handling. The question of hydraulic ram was one on which very little data could be had. Mr. Russell had conducted a series of experiments himself, the results of which were shown, and an empirical the results of which were shown, and an empirical formula deduced. Messrs. Seddon, Wheeler, Johnson, Holman, and Biaisdell took part in the discussion.

THE ELECTRIC CLUB ELECTION.

THE first annual election of the Electric Club since it moved into the new rooms, 17 East Twenty-first Street was held Wednesday evening and resulted in the following gentlemen being chosen unanimously: President, Henry C. Davis; Vice-Presidents, E. T. Gilliland, George W. Hebard, O. E. Madden and George L. Beetle; Secretary, Charles W. Price; Treasurer, Willard L. Candee. The Board of Managers consists of Theodore N. Vail, George B. Coggeshall, Henry D. Stanley, M. W. Goodyear, Cyrus O. Baker, Jr., J. N. Keller, John C. Tomlinson, Charles W. Gould, Charles W. Spear, A. H. Patterson, H. L. Storke, Henry A. Reed and John A. Seely. On the Committee on Membership are Henry Hine, George Worthington, George T. Manson, Henry D. Lyman and Lieut. F W. Toppan, U. S. N.

After the election dinner was served in the club room. and the members listened to the report of President Davis.

MASSACHUSETTS INSTITUTE OF TECH-NOLOGY.

ENTRANCE examinations will be held in Boston on May 31 and June 1. A second series, for those unable to be present in June, will be held on September 18 and 19.

For the convenience of applicants outside New England, entrance examinations will be held on May 31 and June I in the following places:

New York City; Philadelphia, Pa.; Montreal, P.Q.; Chicago, Ill.; St. Louis, Mo.; Cincinnati, O.; San Francisco, Cal.; Washington, D. C.; Nashville, Tenn.; St. Paul, Minn.; Pittsburg, Pa.; Santa Fe, N. M.

To be admitted as a regular student in the first-year class of the School of Industrial Science, the applicant must have attained the age of seventeen years, and must pass a satisfactory examination in arithmetic, algebra. plane geometry, French (or German), English grammar and composition, history and literature, and geography.

For detailed information in regard to requirements for admission and for catalogues of the school, address James P. Munroe, Secretary, Massachusetts Institute of Tech nology, Boston, Mass.

PAVEMENTS FOR LEAVENWORTH.

AT a recent public meeting of the Board of Trade an animated discussion was held regarding the kind of pavement for one of the prominent thoroughfares, the paving of which it was said would cost over \$100,000. The drift of the opinions uttered seemed to be in favor of paving the street with brick, on the ground that a brick-yard to make the brick could be established at home and the money be retained there, whereas if any other sort of pavement were used the money for the materials would have to be sent

BRIDGES IN ALLEGHENY COUNTY, PA.

THE annual report of County Engineer Charles Davis shows that there are 155 bridges in Allegheny County; 33 are of wood, the bulk of which were built 16 years ago. only one of them being still in good condition; 100 are of iron, costing about \$280,000, of which 15 were built last year at a cost of \$50,175. The 10 stone bridges. costing \$30,000, are in good condition. The total amount required for bridge work during the present year is \$128,200, of which \$3.500 is needed for general repairs, \$33,900 for 15 bridge renewals, and \$90,840 to construct 20 new bridges already authorized.

THE contractors for the flushing-turnel at Milwaukee have been using such heavy charges of dynamite as to crack the walls of adjacent houses, and in some instances marble mantels were broken. The Boa Td cf Public Works has directed them to use smaller charges or stop the work.

THE Supreme Court decides in favor of the use of cables on the Third Avenue Railroad. About 450 horse cars on the Third Avenue Railroad, soon to be displaced by a cable, will be sold to the Japanese Government, for use in Tokio, and be shipped around the Horn.-Iron Age.

PERSONAL.

B. V. SIMPSON has been elected City Engineer and Water Commissioner of Winona, Wis.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

WE have received from the United States Fire Clay Co., Cleveland, O., their new catalogue and price-list illustrating the pipe, fittings and other goods manufactured by them.

MESSRS. ROGERS & KING, of Montreal, Canada, have sent us their catalogue and price-list of the different boilers manufactured by them.

TRUE INWARDNESS-BY AN HONEST MAN.

WE have receive a trade catalogue under the above title, which is intended to illustrate the special machinery manufactured by Mr. Ster-ling Elliott, of Newton, Mass. The unique feature of this catalogue is the humorous il-lustrations on alternate pages, which are well rendered, and are calculated to amuse the readers and probably secure the retention of the catalogue. We quote the preface to the catalogue in full:

"It is customary in writing an description.

the catalogue. We quote the preface to the catalogue in full:

"It is customary in writing up descriptive matter relating to manufacturing to begin with the earliest obtainable knowledge of the subject and tell how the ancients used to do certain portions of the work, and then show the various improvements which have been made from time to time. For instance, we might illustrate the first lathe, which had for its respective ends two trees, and in which the rotary motion was imparted by means of a trong cut from the hide of a missionary, and, passing around the piece to be turned, fastened at either end to a bow made of a hickory limb. Then we might go on at length with an attempt to prove that the lathes in use by us are of superior construction to those used by remote antiquity; but, in view of the following illustrations, we feel sure that such a proceeding is unnecessary.

"Illustrated articles descriptive of the various departments of mills and shops have become so common, that, in order to heep 'in the swim,' we have tound it necessary to let the cold, unfeeling world into some of the secrets and inner workings of a manufacture mich one could prefer to keep from the public gaze, and particularly from rival manufacturers. We do not allow strangers inside the works; but, knowing how anxious our customers must be to understand the methods employed in producing fine machinery we show herein some of the many points of interest."—S. Elliott.

ARCHITECTURAL COMPETITIONS.

ST. PAUL, MINN.—Willcox & Johnston, of this city, have been awarded the making of the plans for the St. Luke's Hospital in the competitive contest which has been held. The first building of the hospital to be erected will cost \$75,000.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-viii-320.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

MILTON, ORE.—Water.—It is reported that immediate steps are to be taken towards the construction of the water-works system here.

Brady, Tex.—Water.—Regarding the report that water-works were to be established, County Clerk W. McShaw writes: "Our town is not now in a situation to establish water-works. Will advise you when we are ready to do so"

MONTROSE, COL.—Water.—H. Tarbell, Town Recorder, writes us under date of April 16 as follows: "On A pril 3 at a general electron the qualified electors voted to create an indebtedness not to exceed \$50,000 for the construction of water-works for the town. No steps taken yet to let contract. Will probably have plans and specifications prepared after to-night's meeting of the Board of I'rustees."

Constitute of the Board of Trustees."

CHICOUTIMI, QUEBEC.—Water.—Concerning water-works matters here, our correspondent writes: "On special order from the City Council an engineer, Mr. J. F. Gray, of Quebec, has made a survey and has turnished the Council with plans and probable costs of an aqueduct. A committee has been formed to look for the chances of making it, and as soon as possible tenders will be asked, and if accepted by the electors of the city the work will be carried on."

CARDINGTON, O.—Water.—Concerning the report that a system of water-works was to be erected here, C. W. Case, Secretary of the Board of Trade, writes as follows: "Nothing definite has as yet been done looking toward the establishment of water-works in this place—merely informal talk."

MT. VERNON, N. Y.—Sewers.—The bill before the Legislature authorizing the construction of a \$50,000 sewer for this place having passed, as amended, both Houses and been signed by the Givernor, the village trustees at their meeting April 24 employed C. S. Mc-Clelland to purchase the necessary right of way along its route and engaged Engineer W. E. Worthen, of New York City, to superintend the work. He can be addressed for details.

Chippewa Falls.—Sewers.—Several blocks of sewers are to be constructed here this summer and bids will soon be wanted for the work.

ALTOONA, PA.—Water.—The Board of Water Commissioners has ord-red the laying of several blocks of additional water-mans, also the repairing of others. Details can be furnished by the C.erk of the Board.

WICHITA, KAN.—Sewers.—Santary Engineer Rudolph Hering has been engaced by this city to decide which of numerous sewer projects is the best, and to furnish an accurate idea of the cost of each. After his decision immediate steps will be taken towards commencing the work. Mayor Allen can furnish details.

GLOVERSVILLE, N. Y.—Water.—At a special ballot of the taxpayers in this village, April 20, on the question of obtaining an additional supply of water from a source recommended by the village trustees, the project was deteated by a strong majority. This is the same project which was defeated about a year since. All parties agree that more water is needed, and are willing to be taxed to get it, but, it is stated, a majority appear to believe that the supply from the source in question will prove insufficient.

question will prove insufficient.

KNOXVILLE, TENN.—Sewers.—The Board of Public Works, in a statem in rendered by it to the citizens of this city, has estimated the cost of the proposed sewerage-system at over \$75,000, the amount appropriated for that purpose in March, 1887. The Board suggests that the additional amount required be raised by a system of taxation, and that the work of construction proceed according to the plans, specifications and figures procured by them. The matter is to be left to the taxapyers, who will probably decide at an early day. Details can be had by addressing Isham Young, of the Board.

BUSHNELL, ILL.—Water.—O. C. Hicks, City Clerk here, writes as follows: "Bonds voted for water-works, Stand pipe system contemplated. Action to be taken May 7, 1888."

COOUILLE, ORE .- Water .- The North Coquille Water Co. has been incorporated here with a capital of \$1,200. R. D. Sandford, and others, incorporators.

ORLEANS, NEB.—Water.—The election to decide the water-works question, which was held here April 23, decided in favor of the measure, and operations are to begin at the earliest possible day. For details address the Town Clerk.

LAGRANGE, TEX.—It is reported that water-works are projected for this place.

PENN'S STATION, PA.—Water.—It is reported that a water-works system is to be errected here by Messrs. James A. Chambers and H. S. McKee.

WALDOBOROUGH, Mr.—It is reported that an appropriation has been made for the construction of waterworks here, and that details can be furnished by C. P. Redman.

MEMPHIS, TENN.—Water.—With reference to the extension of the water-works system here by the Artesian Water Company, to which reference was made in our columns last week, Mr. W. L. Cameron, Superintendent, writes us that the two new 10.002,000-gallon pumps, with boilers, etc., contemplated for the permanent plant at the wells are not contracted for, and that there is also a considerable quantity of water-pipe, valves, etc., not yet purchased, for which propositions would be received.

Brunswick, Ga.—Sewers.—It is reported that plans are being prepared for a sewerage system for this place and that the Mayor can turnish details.

SHEFFIELD, ALA,—Sewers.—It is reported that a system of sewerage is to be established here.

Sylacauga, Ala.—Water.—A reservoir is to be built here to furnish water for fire protection.

TECUMSEH, NEB.—Water-Works.—The contract for constructing a complete system of water-works for this place has been awarded to Benjamin S. Clark, of Holdredge, Neb., at a cost of \$20,000.

WATER-WORKS.—See our Proposal Column for information regarding water-works and water-works supplies at the following places: New York City; Clarksburg, W. Va.; Pawtucket, R. I.; Jersey City, N. J.; Chippewa Falls, wis.; Boston, Mass.; Wheeling, W. Va.; Norwalk, Conn.

BRIDGES.

Newton, Mass.—I. F. Kingsbury, City Clerk, writes: "The conscruction of two bridges, of stone arches, is now under consideration, one at Washington Street, Newton Lower Falls, crossing to Wellesley, the other at Bridge Street, Nonantum, crossing to Watertown, both over Charles River. The town of Wellesley hestates in doing its part this year, resulting in delay and possibly involving additional expense, which Newton wishes to avoid."

AUSTIN, TRX.—The project to erect a bridge over the Colorado River, at this place, is progressing rap-idly. Engineer Andrewartha, who is in charge of the estimating and construction, can furnish complete details. Address him as above.

Berrien Springs, Mich.—An iron bildge is to be erected over the St. Joseph River at this place by the County Commissioners.

ASHUBLOT, N. M.—A bridge is to be erected at Fuller's dam.

MILPORD, PA.—Concerning a report that an \$8,000 bridge was to be erected here our correspondent writes; "The tridge in question is not a county bridge. It is owned by a stock company and runs across the Delaware River. Three spans, about 550 feet total length. The stockholders are to meet. May, at which time a new Board of Managers is to be elected. Probably at that date some conclusion may be arrived at. What we want is to know the probable cost of the structure? No doubt ample notice will be given of time of letting contract."

wever, Iowa,—The Supervisors of Des Moines and Lee counties have decided to erect a bridge over the Skunk River at this place, and they have appointed Messrs. Lowery, of Lee County, and Benne, of Des Moines, a committee to advise with some competent engineer, secure his idea as to the most favorable location of the bridge and learn approximately its cost. It is probable that they will take immediate steps toward building the structure. For details address either of the above parties.

PIERRE, DAK.—Bridges.—Mayor C. W. Johnston, of this place, writes us as follows regarding the report that a bridge was to be constructed from here to Fort Pierre: "In reply to your inquiry will say that no bridge company has as yet taken hold of the project for bridging the Missouri at this point. Bills have passed Congress for that purpose, and if the President approves the Sioux bill now before him work will undoubtedly be commenced within a year."

CLEVELAND, O.—Our correspondent writes that the fire at the King Bridge Co.'s shops on the 18th inst. was confined to the roof and walls of the old blacksmith shop and will occasion no delay in their work, as everything was put in operation again in 48 hours, and the entire plant will have been transferred in a few weeks to their new shops.

Grand Forks, Dak.—Our correspondent writes: "The letting of the contract for bridges in this city has been postponed in lefinitely."

DUBLIN, GA.—Our correspondent writes: "Our county has issued bonds to build a bridge across the Oconer River at this place and has sold the bonds for the cash and has the money on deposit in Macon for that purpose, Notice for bids will be published soon. Dublin is accessible by railroad from Tennille on the Central Railroad."

LYNCHBURG, VA.—Concerning the report that the Lynchburg & Durham Rairoad was to erect an extensive bridge over the Staunton River, J. W. Goodwin, the Chief Engineer of the road, writes as follows: "No contracts have been made yet for any truss bridges. All graduations, masonry, trestle and pile work is under contract for sixty nules south of Lynciburg and for ten miles north of Durham, N. C."

FORT HUNTER, N. Y.—There is a project on hand to bridge the Schoharic Creek at this place with a \$20,000 structure. Details can be furnished by N. L. Stover, Amsterdam, N. Y.

ASBURY PARK, N. J.--The Borough Commissioners of this place can give details of a system of bridges to be erected over Wesley Lake by the Ocean Grove Camp Meeting Association.

DUNLAP, TENN.—It is reported that two bridges are to be constructed here, and that details can be furnished by the County Commissioners.

WARREN, MASS.—A 69-foot iron bridge is to be erected here. For complete details see our Proposal Column.

NEW BRUNSWICK, N. J. -It is reported that the Board of Freeholders will erect a bridge here to cost

CHESTERFIELD, N. H.—Concerning the report that a bridge was to be elected over the Connecticut River at this place, City Clerk W. G. Cain writes as follows: "A committee has been chosen to investigate the matter. C. C. P. Goodrich is chairman."

BANCROFT, MASS.—Reports say that the towns of Beckett and Middlefield will erect a large bridge here.

WARSAW, N. Y —It is reported that a large bridge is to be erected here by the Eric Railroad.

Bridges.—See our Proposal Column for information regarding bridge construction at the following places: Independence, Mo.; Emporia, Kans.; Warren, Mass.; Faye teville, W. Va.

GAS AND ELECTRIC-LIGHTING.

UNIVERSITY PLACE, GA .- An electric light plant is to be established here.

LEONARD, TFX.—Gas works are to be established here. Charles Cund is president.

New York City.—The Consolidated Gas Co. will expend \$140,000 on its plant this summer.

MEDIA, PA.—An electric lighting plant, to cost \$10,000, is to be erected here.

Los Angeles, Cal.—The Lowe Gas and Electric Co. has been incorporated. Capital, \$2,000,000. T. S. C. Lowe, and others, incorporators.

ADA, O.—The Ada Natural Gas and Oil Co. has been incorporated. Capital, \$5,000. S. W. Phillips, and others, incorporators.

DBNISON, O.—The Home Electric Light, Heat and lower Co. has been incorporated here. Capital, \$15,-00. M. Moody, and others, incorporators.

WAUWATOSA, WIS.—It is probable that an electric-light plant will be established here. Details can be furnished by J. O. Meyers.

MONTEAGLE, TENN.—An electric-light plant is to be established here.

RAILROADS.

Madison, Wis.—The Wisconsin Midland Railroad Company has filed a resolution with the Secre-tary of State of its intention to construct a line from Fond du Lac to Madison, a distance of seventy-five

Suffolk, VA. — A street railroad is to be constructed here by the Montrose Land and Improvement Co.

NORFOLK, VA.--A street-railroad is to be constructed here. Details can be had by addressing James W. McCarrick.

LEONARD, TEX.-A street railroad is to be built here.

Details can be had of W. T. Gray.

STAUNTON, VA.—It is said that an electric street railroad is to be built at this place by the Staunton. Thomson-Houston Electric Light Co. •

BIDS OPENED.

MONTGOMERY, ALA.—The following bids for constructing sewers were received by City Council April 16: A. Pennel, —, \$57,025,56; Figh & Ball, Montgomery, Ala., \$52,020,66; Howland & Ellis, Boston, Mass., \$44,762,71; J. A. Gabouny, Montgomery, Ala., \$41,724,113; J. J. Everson, Akron, O., \$40,894,25; T. C. Hrooks & Co., Jackson, Mich., \$35,644,16.

The contract was awarded to Howland & Ellis.

The contract was awarded to Howland & Ellis.

New London, Conn.—Sewers.—The following bids for constructing about 3,752 feet 8-inch pipe-sewer, 843 feet 10-inch pipe-sewer, 247 feet 12-inch pipe-sewer, and 200 vertical feet of manholes, were opened, April 19, by the Board of Sewer Commissioners: Jacoby & Madden, Bridgeport, Conn. \$5,556.65; M. S. Austin, New Britain, Conn., \$5,574.60; F. B. Durfey, Norwich, Conn., \$5,602.29; John A. Gill, Boston, Mass., \$5,901.79; C. B. Cadwell, New Britain, Conn., \$5,984.96; Edward McManus, Waterbury, Conn., \$7,180.28; Shaw & Whittlesey, Providence, R. I., \$8,491.35. The contract will also include about 950 cubic yards of rock excavation, the price for which (\$4.50 per yard) is fixed by the Board of Sewer Commissioners.

The contract was awarded to Jacoby & Madden.

The contract was awarded to Jacoby & Madden.

SOUTHBRIDGE, MASS.—Reservoir Dam.—The following bids for reservoir dam were received by A. C. Moore, Esq.: Thomas Hennessey, Holden, Mass., \$3,', 797; G. W. & J. M. Hendrie, Easthampton, Mass., \$4,000; Wellington & Kimball, Burrillville, R. I. \$4,100; I. R. Rooke, Fayville, Mass., \$3,869.50; H. H. Pike & Co., Cambridge, Mass., \$7,863.

MILWAUKEE, WIS.— Hose.—The following contracts for fire-hose have been awarded: Rundle, Spence & Co., 2,000 feet "Hercules" rubber hose, at 90 cents per foot; the B. F. Goodrich Co., 2,000 feet 2/5-inch "White Ancha" rubber hose, at 90 cents per foot.

Boston, Mass.—Carpenter's Work.—The following bids for carpenter's work at the Chestnut Hill pumping station were opened April 21: John McLaren, Boston, \$5,755; W. J. Jobling, Boston, \$7,340; Goodwin & Monroe, Boston, \$7,435. The contract was awarded to John McLaren.

g8c., \$3, \$4.50, \$5 25, \$14.35, \$18, \$55, \$10, \$3.15; total, \$55,254.

Section 5,—12,400 cubic yards, earth excavation and refilling, 50 cubic yards rock excavation, 500 cubic yards concrete masonry, 800 cubic yards brick masonry, American cement, 1 cubic yard dimension stone, 8,500 feet B. M. lumber, 900 spruce poles. H. H. and H. E. Pike, 80 c., \$6, \$5, 25, \$4.25, \$14.25, \$17, \$35, \$33, \$3.25; total, \$40,085. David Hall, 78 c., \$2.80, \$5, \$33, \$3.25; total, \$40,085. David Hall, 78 c., \$2.80, \$5, \$5, 50, \$13.10, \$15,85, \$30, \$25, \$4; total, \$40,781.50, \$12.75, \$15.25, \$27.25, \$2.30; total, \$40,781.50 Michael Kicman, 90 c., 10 c., \$7,50, \$5,50, \$14, \$14.05, \$30, \$25, \$35, \$1013, \$52,672.50.

Section 6.—15,500 cub c yards earth excavation, 50 cubic yards rock excavation, 500 cubic yards forck excavation, 500 cubic yards forck excavation, 500 cubic yards brick masonry, 100 cubic yards trubble-stone masonry, 23,000 cubic yards brick masonry, Portland cement; 5 cubic yards dimension stone mascnry, 60,000 leet, B. M., lumber. William Wittaker, 80c., 25c. \$4, \$45, 50, \$12,70, \$14,70, \$40, \$22; total, \$51,377.50. Thomas S. Rowe, 75c., \$2, \$5, \$6, \$13, \$14, 60, \$34, \$25; total, \$5, 53, \$1, 182, \$12.82, \$14, \$77.50; total, \$45,707. Michael Kiernan, 75c., 10c., \$7,05; \$6, \$14, \$45,50, \$31, \$25; total, \$57.535.

Sr. PAUL, Minn.—Building.—The Board of Manager of the back Cloud Byformatory have reigned all

10C., \$7.05. \$6, \$14.\$14.50, \$31.\$25; total, \$55.735.

ST. PAUL, MINN.—Building.—The Board of Managers of the St. Cloud Reformatory have rejected all bids published recently. At a meeting just held Archit of Stevens submitted his report in regard to the proposed change in specifications for the building, thereby lessening its cost. It was decided to construct the building of brick with granite trimmings, instead of having the walls of granite as at first proposed, and the expense will thus be decreased about \$45.000, leaving the net cost of the building about \$90.000. The secretary of the board was instructed to advertise for bids according to the modified specifications.



Boston, Mass.—Abutments.—The following bids for abutments for Harvard Bridge were opened April 25 by the Commissioners; Boynton Bros., Boston, Mass., \$12,226.05; William H. Ward, Lowell, Mass., \$15,900; Charles H. Edwards, Quincy, Mass., \$18,557; Shields, Carroll & Neelon, Toronto, \$19,659; Thomas A. Rowe, Newton, \$22,500; George S. Barnes, Boston, \$31,012. The contract was awarded to William H. Ward

GOVERNMENT WORK.

MAPQUETTE, MICH.—Court-House.—The following bids for the erection of the court-house here were opened April 17 by the Supervising Architect of the Treasury Department:

Bidders.	1 3. ►	Time.	Amount Using Stone Ashler vs. Brick.	Amount Using Stone Amount Using Stone Ashler and Ashler vs. Brick. 1'4' Walls and Under Solid Stone.	Kind of Stone. Portage Entry and Marquette Brown—so
J. B. Sweatt	\$65,500.00	2 years	\$79,600.00	: *	84,000.00
Corbett & Vanhorn		75 months — brick.	81,000.00		74.418.00 Portage Entry S
: : : :	69,649.00				
::	70,075.00	2 years—stone			80,752.0c Rain Drop.
	70,492.00		• • • • • • • • • • • • • • • • • • • •		
Jas. H. Coster	70,939.00	15 months	101,985.00		97,385.00 Berea Sandstone.
Anderson Bros	72,897.00	20 months	80 257.00		
::	:	: : : : : : : : : : : : : : : : : : : :	81 373.00	_	_
::	:		83,143.00		82,753.00 Ohio Blue.
	:		84,347 00		
McCarthy & Baldwin.	<u>:</u>	20 months			
Bentley & Strachoto	70,990.00	July 1, 1889	87.783.00		Ohio Blue.
	<u>.</u>	- :	:::::::::::::::::::::::::::::::::::::::		Bedford Lime
Wahlman & Grip	_	December 24, 1889.	90,000.00		99,000.00 Portage Entry and Granite.
		:	88,000.00		97,000.00
Stout & Ning			94,200.00		
:	76,541.00		90,100.00		
	70,441.00		88.283.00	_	86,783.00 Marquette Variegated.
The Sandbass & Co	Ť	A	-		
Chas, Sunuberg & Co.		August 1, 1889	_		98,751.00 Sandstone (sample)
Iohn O'Conner	66,60		99,751.00		loi,571.00 Limestone.
onn o connet	delamates	2 Jeans	::::::	•	121,000.00

NEW YORK CITY.—Dredging.—The following bids for diedging in Bridgeport, Conn., harbor were opened April 21 by D. C. Houston, Lieut.-Col. of Engineers: Townsend & Fennell, Boston, Mass., 10c. per cubic yard; A. J. Beardsley & Son, West Stratford, Conn., 145;c.; Henry Du Bois' Sons, New York, 14c.; Hartford Dredging Co., Hartford, Conn., 16c.

olid exterior

NEW YORK CITY.—Dredging.—The following bids for dredging in East Chester Creek were opened April 21 by D. C. Houston, Lieut.-Col. of Engineers: James McSpirit, Jersey City, N. J., 474c. per cubic yard; Hartford Dredging Co., Hartford, Conn., 45c.; Michael H. Flannery, New York, 45c.

NEW YORK CITY.—Extending Bleakwater.—The following bids for extending the New Haven breakwater were opened April 21 by D. C. Houston, Lieut.—Col. of Engineers: John Beattie, Leete's Island, Conn., \$1.39 per ton of 2,240 pounds; Charles H. Edwards, Qu.ncy. Mass, \$1.59; S. & E. S. Belden, Rocky Hil, Conn., \$1.16; A. M. Newton, New York, \$1.60.

FORT WAYNE, IND.—The following bids for steam-heating and ventilating apparatus for the court house were opened April 20 by the supervising Architect of the Treasury Department: Kruse & Barker, \$0,976; Crook, Horner & Co., \$7,100; Samuel I. Pope & Co., \$7,030; Bartlett, Hayward & Co., \$8,340; William Kir-kup & Sons, \$8,425; Madden & Co., \$8,575.

Rup & Sons, 38.425; Madden & Co., 38.575.

JEFFERSON CITY, Mo. —The following bids for the completion of the interior finish of the Court-House were opened April 25 by the Supervising Architect of the Treasury Department: John O'Conner, \$12.850; G. W. Corbett, \$11,100; McCarthy & Baldwin,

WASHINGTON, D. C.—Machine Tools.—Contracts have been awarded for furnishing machine tools for the Nortolk Navy Vard as follows: Niles Tool Works of Hamilton, O., \$20,000; William Sellers & Co. of Phil-

adelphia, \$11,391; Morgan Engineering Company of Alliance, U., \$4,500; Bernent Miles & Co. of Philadel-phia, \$8.375; Manning, Maxwell & Moore of New York, \$2,450.

PROPOSALS.

(Continued from page viii.)

ENGINE HOUSE AND RIVER WORK.— LOUISVILLE, KY.—Proposals are wanted until May 15, for the above work. Address C. R. Long, Presi-dent, Louisville Water Co.

FLAGGING, ETC.—ALBANY, N. Y.—Proposals are wanted until May 7 for flagging, curbing, guttering, etc., certain streets. Address 'l'hos. J. Lanahan, Clerk of the Board of Contract and Apportionment,

REGULATING AND PAVING,—NEW YORK CITY,—Proposals are wanted until May 7 for doing the above work in certain streets of the city. Address the Department of Public Works, as above.

BUILDINGS. — WASHINGTON, D. C. — Proposals are wanted until May 23 for the erection, etc., of several building at Fort Warren, Mass., according to plans and specifications. Address S. B. Holabird, Quartermaster General, U. S. A., as above.

WATER TOWER.—BOSTON, MASS.—Propo-sals are wanted until May 10 for building a water-tower at Mt. Bellevue, Ward 23, Boston. Address Chairman Boston Water Board, as above.

RAILROADS.—MILWAUKEE, WIS.—Proposals are wanted for the work and material for 6 miles of construction, to be done this year, by the Milwaukee Cable Car Co. No date specified. Address H. W. McNeill, Manager and Chiet Engineer, as above.

BRIDGE. — WARREN, MASS.— Proposals are wanted, until May 10, for building the superstructure of a wrought-iron bridge, 69 feet long, at this place. Address Samuel N. Gleason, of the Board of Selectmen, as acrove.

RESERVOIR.—WHEELING, WEST VA.—Proposals are wanted, until May 10, for constructing a reservoir, 50x665, by 11½ feet deep. Address H. P. Wilkinson, Secretary City Water Board.

SEWERS.—NORWALK, CONN.—Propesals are wanted until May 7 for the fourth and fifth divisions of the general stwerage system. Address John D. Kimmey, Chairman Sewer Committee, as above.

Kimmey, Chairman Sewer Committee, as above,

ELECTRIC LIGHTING.—NEW YORK CITY.—
Proposals are wanted until May 9 for furnishing, operating and mair taining electric lamps for the period of one year, commercing May 1, 1888, and ending April 30, 1889, for lighting such streets or parts of streets, parks and public places of the city of New York as may be determined upon by the Mayor, Comptroller and Commissioner of Public Works after the estimates are opened. Address the Department of Public Works, as above.

BRIDGE, FAYETTEVILLE, W. VA.--Proposals are wanted until May 12 for the construction of a bridge over the New River at Fayette Station. Address E. B. Hawkins, as above.

BUILDINGS, WASHINGTON, D. C.—Proposals are wanted, until May 10, for constructing, etc., bu'ldings for officers' quarters at the Marine Barracks, Navy Yard, Mare Island, Cal. Address Horatio B. Lowry, Major and Quartermaster, U. S. Marine Corps, explosive.

WOODEN PIER, NEW YORK CITY.—Proposals are wanted, until May 10, for removing the existing pier at the foot of Jefferson Street, East River, and for preparing for and building a w oden pier and approach, with appurtenances, including a sewer-box, on the site of said pier, to be known as pier, new 36, East River; and for repairing the existing crib bulkhead thereat. Address the Department of Docks, Pier A, North River, as above.

PENITENTIARY.—MANSFIELD, O.—Propos als are wanted, until May 10, for building the mason and irou work of the lutermediate Penitentiary, Ad dress B. F. Crawford, one of the managers, as above.

GAS-WORKS — MERCHANTVILLE, N. J.— Proposals are wanted, until May 1, for the erection, operation, etc., of gas works. Address D. S. Stetson, Chairman Gas Committee, as above.

SEWERS.—CHIPPEWA FALLS, WIS.—Pr sals are wanted for the construction of sewers. date specified. Address the Mayor, as above.

PAVING, ETC.—NEW YORK CITY.—Proposals are wanted, until May 2, for paving and constructing sewers in certain streets. Address the Department of Public Works, as above.

NAVAL OBSERVATORY. — WASHINGTON, D. C.—Proposals are wanted, until June 12, for the construction and erection, by contract, of the new Naval Observatory, to be located on Geo getown Heights, Washington, D. C., and to comprise nine buildings. Complete information can be furnished by the Superintendent of the Naval Observatory, as above, or by R. M. Hunt, architect, Tribune Building, New York City.

MACADAM ROADWAY, ETC. - WASHING-MACADAM ROADWAY, ETC.—WASHING-TON, D. C.—Proposals are want-d, until May 15, for constructing about 1,630 feet of macadam roadway, 14 feet wide, with cobble-stone gutters 2½ feet wide, and about 4,510 feet of macadam roadway, 13 feet wide, with cobble-stone gutters 2 feet wide. Address G. B. Pandy, Deputy Quartermaster-General, U. S. A., Depot Quartermaster's Office, as above.

BUILDING.—ERIE, PA— roposals are wan until May 7, for the erection of a building in this for the Central Presbyterian Church. Address Mimrod, Chairman Building Committee, as above.

CURBING, GUTTERING, ETC.—ERIE, PA.— Proposals are wanted, until May 3, for doing the above work in certain streets in this city. Address George Platt, City Engineer, as above.

SCHOOL.—JAMAICA PLAIN, MASS.—Proposals are wanted until May 1 for building school house according to plans, etc. Address P. W. Ford, architect, 33 School Street, Boston, Mass.

PROPOSALS.

BRIDES, GTRESTLE, AND ABUTMENTS DENVER, COL.—Proposals are wanted, until May 2, for erecting, etc., complete ready for travel, the iron trestle and truss bridges and the Fourteenth Street viaduct, together with all iron abutments, piers, stone footings, etc., according to specifications. Address M. J. McNamara, Presdent Fourteenth Street Viaduct Co., as above.

BRIDGE REPAIRS.—EMPORIA, KANS.—Proposals are wanted, until May 10, for repairing several bidges. Address Roland I akin.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—b s, brown stone; br, brick; br st, brick store; is dwell, brown-stone dwelling; apart house; apart nent-house; tex, tenement; s, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

Ne cor Division and Orchard, hr flat and store; cost, \$35,000; o, TP Hansten; a, JH Valentine.

Ne cor 9th av and 72d, br flat and store; cost, \$100,000; o, Leopold Friedman, a, C Buck & Co.

N 5 72d, 50 e 9th av, br flat and store; cost, \$90,000; o and a, Chas Buck & Co.

S s 82d, 125 e 5th av, 6 br dwls; cost, \$90,000 all; o and a. Fd Kilpatrick.

56-58 E 122d, br flat; cost, \$35.000; o, Jas Gilroy; a. Wm Keshles.

23 10th av, br store; cost, \$8,000; o, Henrietta M Kuhmost; a, Thos Keich.

431 E 9th, br flat; cost, \$20,000; o, C A Ruff; a,

431 E 9th, br flat; cost, \$20,000; 0, C A Ruff; a, Schneider & Herter.
207-709 E 4th, 2 br flats; cost, \$40,000 all; 0, M Grossner; a, Kintzer & Rohl.
S 176th, 100 w West End av, br dwl; cost, \$25,000; 0, P Knauth; a, Lamb & Rich.

N s 85th, 68 w Av B, 2 br flats; cost, \$32,000 all; o, H P Kelly; a, J Munckwitz.

S s W 68th, 300 w 10th av, br stable; cost, \$8,000; o, G Boune; a, G H Gribel.

120 E 125th, br bldg; cost, \$16,000; o, N Y C Fire Dept; a, N Le Brun & Sons.

S s 83d, 200 w oth av, br bldg; cost, \$17,000; 0, N Y Fire Dept; a, N Le Brun & Sons. 291-293 Grand and 92 Eldridge, br store bldg; cost, \$25,000; 0, Michael Berryman; a, Herter Bros.

7th av, s w cor 14th, 1 br flat with stores; cost, \$40,-000; o, Hy Meinken; a, J W Cele; b, J Jordan.

208 F. 25th, br ten; cost, \$18,000; o, A. Weinstein; a, Rentz & Lange.

521 W 30th, br stable and workshop; cost, \$7,000; o, W H Pinne; a, C Perry.

228, 230 and 232 E 24th, 3 br flats; cost, each, \$16,000; o, E Mulvaney; a, John Sexton. 200 E 51st. brown stone flat; cost, \$20,000; o, W J Smith; a, Thom & Wilson.

4th av, s w cor 116th, br store and flat; cost, \$30,-20; o, a and b, T P Dunne.

84th, s s, 90 w 9th av, 2 brown stone flats; cost, \$45,000 each; 0, M Brennan; a, Thom & Wilson.

94th, s s, 200 w 8th av, 12 br and stone dwells; cost, about \$12,500 each; o, Increase M Grenell.

125th, s s, 50 w 7th av, iron and glass bldg for stores; cost, \$25,000; o, A S Walker; a, T E Thomson.

ALTERATIONS-NEW YORK.

125-31 2d; cost, \$15.000; o, St Nicholas Roman Catholic Church; a, Herter Bros.

Park pl, s e cor College pl; cost, \$15,000; 0, J F Knapp; a, N Le Brun & Sons. 123 Bowery; cost, \$7,000; o, Mary Anderson; a, J S Wightman.

33-43 Gold, br factory; cost, \$8,000 all; o, Excelsior Steam Power Co; a, W C Grinnell.

S w cor Madison av and 20th, br church; cost, \$25,-000; o, not given; a, S A Warner.

372 Broadway, br bldg; cost, \$7,694; o, S Wyman executor; a, not given.

N s 146th, 375 e Brook av, br bldg; cost, \$12,000; o, Henry Uhl; a, Carl Pfeiffer,

BROOKLYN.

1,004-1,006 Gates av, 2 br tens; cost, each \$8,000; o, Wm H Murtha; a, W Field & Son.

Stuyvesantav. n w cor Quincy, br st and flat; cost, 9,500; o and b, John McDicken; a, E Dennis.

\$3,000; 0 and 0, joint medical, a, E Dennis,
Union av, w s, 97.7 n South 1st, br ten; cost, about
\$3,000; 0, Lingke Bros; a, F J Berlenbach, Jr.

N s S 9th, 200 e Bedford av, 2 br dwells; cost, \$24,000 all; 0, B Gallagher; a, F F Taylor.

N s 2d, 122 w 8th av, br dwells; cost, \$10,000; 0, H Thomas; a, H S Ihen.

N e cor De Kalb av and Spencer, br dwell and store; cost, \$10,000; o, M Moran; a, I D Reynolds.

Ns De Kalbav, 200 e Spencer, br dwells and store; cost, \$10,000; 0 and a, as above. N s Halsey, 300 e Reid av, 4 br dwells; cost, \$r6,000 all; 0, C H Roberts; a, Amzi Hill.

Ns North 12th, 100 w Kent av, br pas retort house; cost, \$15,000; o, Williamsburg Gas Light Co; a, C Rowland.

N s Lexington, 400 e Marcy av, 4 br dwells; cost, 20,000 all; o and a, Jos C l'aylor.

18 to 62 Hart, 3 br dwells; cost, \$18,000; o, John Parkins; a, W Josiah.

Sw cor Hamburg av and Suydam, 4 fr dwells and stores; cost, \$7,200 all; o, W Dickinson; a, Schrempfeud & Loeffler.

Ss DeKalb av, 102e Cumberland, br st and dwells; cost. \$16,000; o. Dr A W Shepard; a, John Mumford. ALTERATIONS-BROOKLYN.

Nostrand av, s w cor Kosciusko; cost, \$10,000; o, Wm L Eagney; a, I D Reynolds.

BUILDING INTELIGENCE

BROOKLVN-Continued

Vernon av, s s, 200 w Throop av, 3 brong av dwells; cost, each \$5,500; o and b, James W Mean, I D Reynolds.

Van Buien, n s, 375 e Sumner av, 4 b st dweis; CN each, \$5,500; o and b, David Beasley; a, 1 D kep.o.g. Van Buren, n s, 453 e Sumner av, 8 b s dwells; c.s. each \$5,000; o, a and b, same as last.

Broadway, n e cor Palmetto, one br st andten, os. \$12,000; 0, George B Goodman.

MISCELLANEOUS.

ST. LOUIS, MO.—Morgan and Pendleton sts: w 4s cost, \$7,000; o, Mrs H J Force; b, T F Marley Compton av and Chestnut st; br dw; cost, \$10 to 0, J Meier; b, F Green.

Chippewa st and Broadway; br hall: cost, \$5,000 o, C Steinmeyer; b, C H Tacke.

SPRINGFIELD, MASS.—U S Armory; 2-story bran stocking-shop, 36x279; contract not let,

TUSCUMBIA, ALA.—2-story br store; cost, \$1.00 o, Ernest Troye. Brick residence, store, etc.; cost, \$50,000; c. Jan. P. Richardson; a, Thos Sully; b, by day work.

Frame residence; cost, \$7,000; 0, CE Smith; 4, # H Floyd; b, by day work. Poplar and Ninth sts; br store; cost, \$7,000 o F L Pugger, W H Floyd and E Watkins; 2 4 f Floyd and Thos Sully; b, H C Jackson.

KANSAS CITY, MO.—Harrison, cor toth st, lete. cost, \$10,000; o, E W Culver.

Alexander pl, 7 fr dw; cost, \$10,500; o, G A Heartist and Virginia ave, 12 dw; cost, \$50.30 o, J J Kelly.

102 bldgs costing less than \$7,000.

BOSTON, MASS.—Elm Hill av. cor Sinclair, weed-dw; cost, \$12,000; o, a and b, A S Drisko. 173 Dudley, wooden dw; cost, \$10,000; 0 and Henry Kelley; b, C A Jefferson.

516 Warren, wooden stable; cost, \$10,000; 6, Sime T Young; a and b, John French.

ST. PAUL, MINN.—Thomas nr Glaghotn, 2 start br school; cost, \$33.500; o, Board of Education. Sixth or Jackson, 3 story br block; cost, \$5,000.

Goodrick nr Dale, 2 story br dwell; cost, \$9,000; 5, C A Moore. Goodrich nr Dale, 2 story fr dwell; cost, &, oc. 4. A R Bushnell.

Pleasant av nr Chestnut, 5 story brienementos \$31,000; 0, J Farrington.

128 minor permits, \$154,000

MILWAUKEE, WIS.—W s 20th st, below Fowlers and Mount Vernon road, 12 fr dws; cost, \$14,60 6. Dr Chas L Stadler.

Ne cor 19th and Clybourn sis, fr dw; cost, \$7.00. o, C L Stadler.

Cor 11th st and Central av, 2 story br bldg; os: \$8,000; 0, John Weber.

Kinnickinnic av, br dw; cost, \$7,000; 0, loi: Kohl.

67 dwellings less than \$7,000

W Water st, 4 story br bldg; cost, \$18,000; r.C. Manegold & Son. W Water st, 4 story br bldg; cost, \$20,000; c. Frd Layton & Co.

12 stores less than \$7,000.

Se cor Van Buren and Oreida, stone and broketh cost, \$50,000; o, Plymouth Church Congregated 3 churches less than \$7,000.

MILWAUKEE. - 195-197 Prospect av. double but dwell; cost, \$12,000; o, Geo W Peck. N s Clybourn, bet 6th and 7th, double dwell; ces. \$7,000; 0, James Roache.

N w cor 3d and Harmon sts, br bldg, 30r50; ccs.

Milwaukee River, north of Knapp, manufactor, ox80: cost, \$10,000; o, Frank & Son.

N w cor Brady and Farwell av, br store; ces. \$7,000; o, G P Frnst. 20th (near Wells), br dwell; cost, \$7,000; 0, Robel J Brenk.

Jackson, below Biddle and Oneida, br addition to school; cost, \$7,000; o, J J Keogh of St John's Cath-

84 W Water, br stone; cost, \$30,000; 0, Jitz Plankinton. Lake, livery stable; cost, \$7,000; 0, Ben Mock; i. Crane & Barkhausen.

Vliet, br store; cost, \$9,000, o, C & Reichart.

Jefferson st, near Junean av, br dwell; cost, \$.,0x o, F L Vogel & Son. National av, block of dwells; cost, \$7,000; 0, E Felthousen.

Clybourn st. 3 bar dwell; cost, \$7,000; 0, P McCab Market, br bldg for factory; cost, \$10,000; 0, WE

The Wisconsin Central Railway of this city of unite with the Chairago and Great Western Railway and build a \$1.5-50,000 mammoth railroad depot if Chicago.

E T Mix & Co., of this city, have secured the poor of erecting a new office bldg for the St Paul (lieb. F St Paul to c ist \$150,000.

STOCKBRIDGE, MASS.—3 story br add to revolved works, 37x107; 0, Smith & Wesson; a, Jason Perkint, b, contract not let.

ST. CLOUD, MINN.—The electric light congri-will erect aprick building to cost \$0,000. Ib-building improvements planned for this year agen-gate \$1,000,000.

SUPERIOR, WIS — The North-Western Forl Conpany will build superstructure and detricks for couldocks here capable of handing 300,000 toos.

ST. PAUL, MINN .- The Clinton Avenue Methods: Church will build a \$30,000 edifice.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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TUBERCULOUS HOUSES.

CAN a house become so infected that those who live in it for any length of time are specially liable to become affected with consumption? It seems very probable that this may occur, and that a certain proportion of those cases of consumption which are said to be due to heredity, as where several cases occur in one family, are in reality due to common residence in an infected house.

The volume of the transactions of the Epidemiological Society of London for 1886-7 just published contains a paper by Dr. Arthur Ran-some entitled "Some Evidence Respecting Tubercular Infective Areas," in which this question is discussed, and attention is especially called to the frequency with which groups of several cases of deaths from consumption in one family occur in small, badly-ventilated cottages situated on damp clay soils. With our present knowledge of the conditions necessary for the growth of the tubercle bacillus, and of the very persistent vitality of its spores as found in matter spit up by consumptives, seeing that this matter may be dried and ground to dust and yet the spores remain for weeks capable of development into the specific bacilli if they can only get a week's lodgment where they can get food and a sufficiently high temperature, it is probable that every one inhales more or less of these spores, but that in healthy lungs and throats they do not flourish and are soon removed.

If, then, we accept the theory that a particular group of houses, or even a particular house, may be specially dangerous as a cause of tuberculous disease, it must be because the bacilli or their spores are found in such places in unusually large quantity, or because the locality and conditions are such as to specially favor the growth of these organisms, or because the locality and conditions exercise such an influence on those who live in them that the bacilli find it possible to grow and develop in their lungs or air-passages, or, finally, because of a combination of these. The first reason is not a probable one, because very careful investigation in hospitals for consumptives, in which the number of bacilli and spores present must be relatively large, does not indicate that healthy persons, such as nurses, etc., living in them are specially liable to contract the disease.

It is dampness and want of ventilation that makes a house or a group of houses dangerous, and they probably do this, in large part at least, by causing or promoting slight inflammations of the air-passages, sore throats, bronchitis, etc., which lower the vitality of the tissues and so make them fit to support the tubercle bacillus.

If into such dangerous houses a case of consumption is brought, it is easy to see how the house may become infected and a source of specific contagion as well as of general debility or disease.

Dr. Ransome gives illustrations of the wide difference in the death-rates from consumption between different squares or groups of squares in Manchester and Salford, showing that it is in the narrow streets and courts, where there are many back-to-back houses having usually no cellars and no ventilation, that the mortality from consumption is greatest. The moral is the same as usual—seek a well-ventilated, thoroughly dry house, on a dry subsoil, and you need not worry overmuch because you have "consumption in the family." It is consumption in the house that you have most to dread.

DANGEROUS ELECTRIC-LIGHT WIRES.

On April 15 a young man was instantly killed in New York by touching the pendent end of a "dead" wire. It appeared from expert evidence given at the coroner's inquest that the insulation of electric-light wires is necessarily imperfect in wet weather, and that in such weather if two "dead" wires are in contact with the same electric-light wire, no matter how far apart, and reach one to the ground and the other nearly so, a person standing on the ground and touching the latter wire will receive the full charge of the dynamo. It was stated that there are many miles of "dead" electric-light wires on the poles, as it costs as much to take a wire down as to put it up, and the opinion was expressed that the underground system was the only safe one.

The verdict of the jury was to the effect that the death was caused by the neglect of the United States Illuminating Co. in not removing the loose wire.

Since this accident another death has occurred in the same city from touching a low-hanging " live" light wire.

CAUSE OF DELAYS IN GOVERNMENT WORK.

As an illustration of the various causes that produce delays in the prosecution of Government work for the improvement of our rivers and harbors, we would cite the recent report of General Duane, Chief of Engineers, U. S. A., forwarded to Congress by the Secretary of War, in which it is pointed out that the improvements for the navigation of Black Warrior River, Ala.; Cumberland River, Tenn.; Kentucky River, Ky.; and the Allegheny River, Pa., and the improvement of the harbor at Ludington, Mich., are either delayed or cannot be commenced for the reason that there is not legal authority to acquire the land necessary for the erection of the improvements thereon.

A bill has been introduced in Congress authorizing the Secretary of War to institute proceedings in the name of the United States to enable him to condemn land, secure right of way or material needed for the prosecution of work authorized by Congress, providing, however, that when the owner of such land or right of way fixes a price that the Secretary of War considers reasonable, he may purchase the same at such price without further delay. Until this bill is passed we presume these improvements cannot be carried out, notwithstanding an appropriation has been made therefor.

THE ASSEMBLY CHAMBER CEILING IN THE CAPITOL AT ALBANY.

WE give, on another page, the final report of recommendations of the expert commission appointed by the Legislature some three months ago to examine the vaulted stone ceiling of the Assembly Chamber of the New York State Capitol. Their preliminary report was given in our issue of February 18.

The commission consisted of John Bogart, State Engineer and Surveyor; Thomas C. Clarke, Civil Engineer; and Richard M. Up-john, Architect; and to the former of these



gentlemen we are indebted for copies of these reports and for courtesies extended to our representative who recently visited Albany and made a careful examination of the defective structure, and secured data from which we propose in an early number to give such an illustrated description as may enable our readers to clearly understand the points at issue.

OUR ARCHITECTURAL ILLUSTRATIONS.

AN OLD PORTAL.

A HOUSE IN WORCESTER, MASS.—PEABODY & STEARNS, ARCHITECTS.

REPORT ON ASSEMBLY CHAMBER CEILING, NEW YORK STATE CAPITOL.

To the Honorable the Speaker of the Assembly of the State of New York:

SIR: Under a concurrent resolution of the Legislature the State Engineer was requested to cause an examination to be made of the Assembly Chamber in the new Capitol,

and subsequently an additional centre was found necessary and put in place to support one of the ribs of the northern vault.

At the request of the committee a second report was made on March 7, 1888, confirming the recommendations of the first report that the ceiling be taken down, and adding that its place should be supplied by one of lighter construction and more favorable for parliamentary pur-

poses.

We now beg to submit a final report.

Before referring in detail to the ceiling of the Chamber, we desire to refer to the condition of the staircase adjacent to that Chamber. This condition is such that it must be repaired, and we judge from the examination that can at present be made, that the repairs may be effected by rebuilding the part below the first floor with new and enlarged foundations. But it is possible that further developments, when the work is entered upon, may show that it will be necessary to take down and rebuild the whole of this staircase. We think, however, that this will not be requisite.

requisite.
Our examination of the foundation of the structure leads us to say that the base of the main tower, now unfinished, is very heavily loaded, and, in our opinion, it will be unwise to continue a heavy construction for this tower; and, in fact, to add any great weight upon that foundation, without, in some manner, enlarging its area.

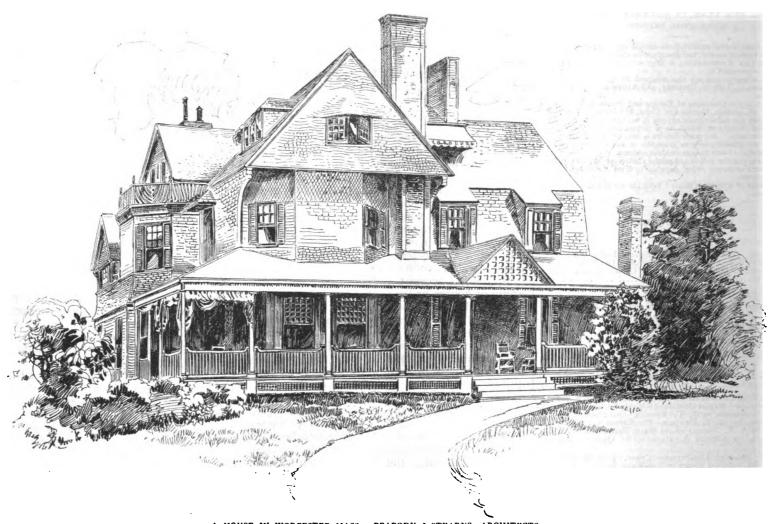
the ceiling of the Assembly Chamber were defective. We have also been informed by a number of members of that body that the acoustic properties have been decidedly imbody that the acoustic properties have been decidedly improved since the temporary flat ceiling of plank has been in position. This leads to the suggestion that the new ceiling should be flat, and it may be constructed of wood or of metal, possibly with glass panels. It would then be similar in treatment to the ceilings of the Senate or House of Representatives at Washington, or to that ceiling of the Senate Chamber in the Capitol at Albany. Skilled architects can undoubtedly design such a ceiling so as to give to the Assembly Chamber a stately and ornate architectural effect. The weight of such a new construction would be much less that the present ceiling.

The brick and iron floor over the Assembly vault need not be replaced unless possibly by a light fire-proof construction as a protection to the new ceiling below.

The side walls of the three dormers should be replaced by metal and slate.

The side walls of the three dormers should be replaced by metal and slate.

When these weights are removed, and the new weight added, the walls of the rooms below the Assembly Chamber will be relieved of some 2,700 tons of load, and we do not anticipate, in that event, further serious settlements or cracks. We recommend that the golden corridor be repaired by removing the easing of the wall piers and putting in heavy iron girders at the floor-level to carry these piers which now rest on brick corbels. New stone must



A HOUSE IN WORCESTER MASS, -- PEABODY & STEARNS, ARCHITECTS

and particularly the ceiling and foundations and supports thereof, for the purpose of ascertaining its present condition and stability, and danger, if any, to be apprehended therefrom, and to associate with him in such examination and report Mr. Thomas C. Clarke and Mr. Richard M. Upjohn, and to report the results of such examination, together with their judgment as to the remedy for such defects as should be revealed by their investigation.

Immediately upon receiving notice of this appointment the Commission designated by the resolution met, examined the drawings furnished, and also made a personal examination of the ceiling of the Assembly Chamber. This examination revealed such a dangerous condition of things that a report was at once made to the Legislature on February 3, 1888, upon the pressing and immediate question of danger. In that report the actual condition of the ceiling was described and reference made to the numerous fractures found in it, and recommendation made that the Assembly Chamber be immediately vacated, that strong and properly-supported centerings be put up, and strong and properly-supported centerings be put up, and that the whole of the ceiling be taken down as soon as possible, and such steps taken as would relieve the pressure on the walls and supports.

Action was taken by the Assembly upon this report, and a square tower of timber was erected in the Chamber, its supports being carried to the foundations, and upon it

centres were put supporting the ribs of the main vault,

Referring now to the Assembly Chamber, and that portion of the building above and below it, we recommend that the following portions should be removed with as little delay as possible after the close of the present

1.438 tons. Total weight removed..... 3.230

The weight of the two gable walls in the attic support

The weight of the two gable walls in the attic supporting the chimneys may be transferred by trusses to the walls at the side of the central arch.

It is the opinion of this Commission that a design should be adopted for the reconstruction of this part of the Capitol building which will throw upon the walls and foundations as small a weight as is consistent with good construction and proper architectural effect. This can be effected by a ceiling of wood or of metal, constructed so as not to throw lateral pressure on the outer walls and so as to load the supporting walls below the Assembly floor as little as possible.

It has been stated to us by many members of the Legis-

It has been stated to us by many members of the Legis lature that the acoustic properties of the stone vault of

when take the place of that which is now cracked and shattered. The casings of the temporary library should be repaired in the same manner.

When these things are done, and we believe they can be completed before the beginning of the session of 1889, this portion of the Capitol building will, in our judgment, be in a safe and permanent condition, and require only the ordinary repairs.

It seems proper that this Cameria.

It seems proper that this Commission should add that the lamentable condition of parts of this great building is not due to bad workmanship, because the workmanship is really very good. Neither is it due to bad foundations, because we find that the settlement of the foundations has been slight and not very irregular, while those foundations are, in places, loaded beyond what was intended in the original design and construction. The ruin of the vaulted ceiling is due to the fact that dedesign and method of construction and loading of these arches and vaults have been such as to give pressures which have resulted in the disintegration of the structure; the joints being, in many places, open, and in others compressed to such an extent that the stone has splintered and is full of cracks.

All of which is respectfully submitted.

(Signed)

JOHN BOGART,

THOMAS C. CLARKE,

APRIL 16, 1888. APRIL 16, 1888. PRICHARD M. UPJOHN.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

AN OLD PORTAL.

CEDAR-BLOCK PAVEMENT AT LEAVENWORTH, KANSAS.

NOTICING in an exchange a discussion regarding proposed new pavements for Leavenworth the statement that a cedar-block pavement on a certain street had proved a failure, we wrote to City Engineer George T. Nelles asking for facts and details as to the manner in which the pavement was laid. The following is from his reply:

The pavements in question were put down on two of our principal business streets and on one resident street, and consisted of 7-inch sound white-cedar blocks 4 to 8 inches in diameter laid on a 6-inch concrete foundation. The work was all done in accordance with the specifications in general use for this class of work. The work was done during the summer and fall of 1887, so that the reliable test of use cannot be brought into play. So far as I am able to judge from my knowledge of the manner in which the work was done, and from present indications, the work will become a perment and letting as any payment of this prove as permanent and lasting as any pavement of this class. The cedar blocks were of unexceptionally good quality, live and sound, and free from the usual imperfecquality, live and sound, and free from the usual imperfections of this class of material. The assertion made in the clipping herewith to the contrary is absolutely without foundation. Owing to the inferior quality of the sand and broken stone available here for carrying on works of any magnitude, the concrete foundation may not be up to the standard. Still I confidently believe it is ample for the purpose, and that it will outwear a great many sets of condar blocks. I have recently had occasion to examine cedar blocks. I have recently had occasion to examine some of the concrete laid during freezing weather last fall, and found that, although not perfectly set, it has not been in the least disturbed by the frost or the traffic over it. I have not arrived at the true inwardness of the attack on cedar pavements, but think that the idea that the pavements laid last year are failures arose from the fact that several very ugly settlements have taken place where the pavement was laid over heavy fills, which, until repaired, greatly injures the appearance of the work; and from which was put down without cross-ties by laying the streingers directly on the concrete, and being dependent entirely on the blocks to hold it down, and in consequence has raised the blocks in places. There is nothing, so far as I can see, connected with this work that can be cited as an experience with cedar block pavements."

STRENGTH OF CEMENT MORTAR.

BY IRA O. BAKER,

Professor of Civil Engineering, University of Illinois.

[Written in answer to a correspondent who, on page 294 of THE Engineering and Building Record, inquired for data on the strength of cement mortar, particularly in thin layers.]

NEARLY all experiments on the strength of mortars have been made to determine its tensile strength. That this is unfortunate has been admirably shown in the excellent article on "Cement Mortars," by E. Kuichling, Mem. Am. Soc. C. E., lately published in this journal. The following table, carefully compiled from a large number of reliable experiments, gives the tensile strength of cement mortar:

Table Showing the Tensile Strength of Cement Mortars.

Compo of 1			Rosen	DALE.			Port	LAND.	
Mor	tar.	A	lge of	Mortar		1	Age of	Mortar	
Cement.		1 week.	t month.	6 months.	r year.	ı week.	1 month.	6 months.	ı year.
ī	۰	100	180	275	300	300	400	450	500
1	1	60	100	180	225	175	250	340	375
I	2	25	60	125	170	120	150	245	290
I	3	20	40	80	121	90	110	175	220
1	4	15	25	60	90	75	75	130	170
1	5	10	15	50	80	60	65	110	130
1	0		10	45	75	50	35	90	100

An examination of the results of about sixty experiments, made with the U.S. testing machine, seems to show that the compressive strength of mortar, as determined by testing cubes, is from 8 to 10 times the tensile strength of the same mortar at the same age. Of course these results are not very valuable as showing the compressive strength of mortar as employed in the joints of masonry. It is well known that mortar when tested in thin layers between materials stronger than itself is considerably stronger than when tested in cubes. The increase in strength depends mainly upon the thinness of the joint and the strength of the pressing surface. No extended experiments have been made in this direction.

The following data on the compressive strength of concrete will give some idea of the relative compressive strength of mortars of different composition.

The compressive strength of 6-inch cubes of concrete exposed to the air for six months, as determined in connection with the construction of the St. Louis Bridge, was as follows: with the proportions of I part cement (Akron and Louisville), 1 part sand, and 4 parts broken limestone, the mean compressive resistance from nine trials was 1,200 pounds per square inch (85 tons per square foot). With the proportions of 1, 2, 4, the average resistance of twelve trials was 940 pounds per square inch (70 tons per square foot). Tests with the U.S. testingmachine, at Watertown, Mass., between steel gave an average of 1,544 pounds per square inch (110 tons per square foot) for 4-inch to 16-inch cubes of concrete 46 months old, composed of I part Rosendale cement-paste, 1 ½ parts sand, and 6 parts broken stone. Under the same conditions concrete composed of I Rosendale cement paste, 3 sand, and 6 broken stone stood 102 pounds per square inch (73 tons per square foot). Another sample of cement gave 1,078 pounds per square inch (77 tons per square foot) for concrete, 22 months old, composed of 1 part cement, 3 sand, 2 gravel, and 4 broken stone. Ten experiments with a single sample of Portland cement gave 3,067 pounds per square inch (219 tons per square foot) for Portland concrete composed of I cement paste, 3 sand, and 6 broken stone. The concrete under the Washington monument, composed of I Portland, 2 sand, 3 pebbles, and 4 broken stone, when six months old stood 144 tons per square foot.

The data in the following table, even if not exactly in the line asked for, are very instructive. The experiments were made with the large U. S. testing machine at Watertown Mass., upon brick piers 12 inches square and from 1 foot 4 inches to 10 feet high, and gave the compressive strength as follows:

1 .		=		_				Reference No.
	7 Clear Portland cement I	6 Clear Rosendale	5 1 Portland cement, 2 sand 8	4 r Rosendale cement, 2 sand I	3 2 mortar, (1 lime, 3 sand), 1 Portland cement 1	2 2 mortar, (1 lime, 3 sand), 1 Rosendale cement I	I lime, 3 sand	COMPOSITION OF MORTAR.
-		-	3 2,544	1,972	1,411	1,646	5 1,508	Ultimate strength of pier in pounds per square inch.
-	2,375 3,483	521	545	162	192	183	124	Strength of the mortar tested in 6-inch cubes between steel, in pounds per sq. in.; mean of 3 trials.
	:	:	10	:	i	:	٥	Min.
		:	27	:	:		200	Strength of pier per sq inch in per cent. of the strength per sq. inch of the brick.
	16	:	17	13	9	::	5	Mean
	0.7	:	4.7	12	7	9	12	Strength of the pier in terms of the strength of the mortar, each per square inch.

The brick were unusually strong, having an average strength of nearly 1,500 pounds per square inch, tested flatwise between steel; it does not appear that an increase of 50 per cent. in the strength of the brick appreciably affected the strength of the masonry. The mortar was 141/2 months old when tested. The piers were from a year and a half to two years old when tested. The strength of the piers varied with the height; in a general way the experiments show that the strength of a prism 10 feet high laid in either lime or cement mortar, is about two-thirds of that of a 1-foot cube laid in the same way, although a conclusion derived from so few experiments (22 in all) is not entirely reliable.

In attempting to draw conclusions from any experiments, it must be borne continually in mind that the result of a single trial may possibly be greatly in error; in this case, this precaution is very important, since the difference between experiments apparently exactly alike was in some cases as much as 50 per cent. A great variation in the results is characteristic of all experiments on stone, brick, mortar, etc. Except on the ground of a variation in experiments, it is difficult to explain why the fourth mortar

is weaker than the second, while the masonry is stronger; or why the masonry in the fifth line is stronger than that in the seventh. However, the experiments are enough to show conclusively that increasing the strength of the mortar adds to the strength of the masonry; for example, notice that the substitution of the fifth mortar in the table for the first adds 70 per cent. to the strength and doubtless much more to the durability. Similar experiments* show that masonry laid in mortar composed of one part Rosendale cement and two parts sand is 56 per cent. stronger than when laid in mortar composed of one part lime and four parts sand. A member of the Institute of Civil Engineers (London) says that "brick-work laid in lime is only one-fourth as strong as when laid in clear Portland cement.'

Of course, the apparent efficiency of the masonry, as given in the table, depends upon the manner in which the strengths of the brick and mortar were determined, as well as upon the method of testing the masonry; for example, if the brick had been tested on end the apparent efficiency of the masonry would have been considerably more, or if the mortar had been tested in thin sheets the strength of the masonry relative to that of the mortar would not have been so great. The piers began to show cracks at onehalf to two-thirds of the ultimate strength.

It should be mentioned that the mortar with which these piers were built appears to be much weaker than similar mortar under like conditions; compare 72 and pages 126, 166, 188, 197 of the Report of Tests of Metals, etc., made at Watertown in 1884. Ordinarily mortar is 8 to 10 times as strong for compression as for tension, whereas the first six mortars in the preceding table were but little stronger in compression than such mortar should have shown under tension. The officer in charge is "unable to offer any explanation; the cement was bought on the market, and the maker's name is not known." The cement was not tested. However, the experiments are consistent within themselves, and therefore show relative strengths cor-

Some German experiments; gave results as in the table below. It is not stated how the strength of the brick or of the masonry was determined. The term cement in the table refers to Portland cement. The permissible strain allowed on brick masonry by the building regulations of Berlin are less than one-tenth of the results in the table.

DESCRIPTION OF BRICK.	Average crushing strength of brick alone.	Ultimate strength in lbs. per sq. in. of brick - work with mortar composed of				
	in pounds per square inch.	1 Lime. 2 Sand.	7 Lime. 1 Cement. 16 Sand	I Cement. 6 Sand.	r Cement.	
Ordinary stocks	2030	120	139	161	18:	
Selected stocks	3669	162	176	202	232	
Clinkers	5390	237	259	296		
Porous bricks	2617	115		144	16	
Porous perforated bricks	1195	53	57	65	7	
Pertorated bricks	2759	121	132	152	171	
Average efficiency of the mass of the strength of the bricks	onry in per cent.	44	48	55	6:	

CARL PFEIFFER.

R

In the death at Washington, D. C., April 27, of Carl Pfeiffer, the profession and American Institute of Architects has sustained the loss of an active and prominent member who is deeply mourned by a wide circle of friends and associates.

Mr. Pfeiffer came from Germany to this country at the Mr. Pfeiffer came from Germany to this country at the age of 15, about 35 years ago, and has devoted himself zealously and successfully to his professional duties, which of late years have been largely of consultation. He was prominent in hospital and asylum work and especially interested in the accompanying ventilation problems. He was the architect of the Church of the Messiah, the Roosevelt Hospital, the Insane Asylum at Middletown, and the Comman Hospital at Seventy seventh Street and Fourth German Hospital, the Insale Asylum at Middletown, and the German Hospital at Seventy-seventh Street and Fourth Avenue, New York, Fifth Avenue Presbyterian Church (Dr. John Hall), besides many other important edifices.

He was for two years Secretary of the American Institute of Architects, and was a member of the National

Academy.

For some years his health has been precarious, and he was overtaken by his last illness while returning to New York from Asheville, N. C., which he had visited in vain hopes of benefit from the change.

+ erun - should be 15000 lbs.



^{*} Report of Experiments on Building Materials made for the city of Philadelphia on the U. S. testing machine at Watertown, Mass.,

⁺ Proceedings, Vol. XVII., p. 441.

[†] Van Nostrand's Engineering Magazine, Vol. XXXIV., p. 240, from the abstracts of the Institution of Civil Engineers London).

BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXXII.*

* This heading was accidentally omitted from the accounts of the erection of the Harlem Bridge and of the Poughkeepsie Bridge in the issues of January 21 and March 3, respectively, which should have been numbers XXIX. and XXX. of the series.

(Continued from page 300.)

ERECTION OF POUGHKEEPSIE BRIDGE.-NO. 2.*

MASONRY.

THE safe completion last fall of the submerged work successfully terminated an enormous and costly task, which was subject to many unusual and complicating conditions.

About 40,000 barrels of cement were used in the cribs. and 20,000 in the masonry, 11/2 or two barrels being required per yard for the concrete. Portland and Rosendale brands were used, subjected to continual tests of specimens taken from at least every tenth barrel. The specimens tested were molded into briquettes of the standard form and section recommended by the American Society of Civil Engineers. Several briquettes of neat cement were made of each sample and allowed to set from one to sixty days in the air and under water, and were then broken in the machine described on page 117 of our issue of January 21. The specifications required standard strength, which was attained in all cement used. The concrete in the cribs was made in the proportion of one part cement, two parts sand and three parts broken stone, crushed when necessary to pass through standard gauge.

Figures 5 and 6 show the Cockburn Barrow and Machine Company's steam-mixer used for making concrete for the A square iron box B is provided with collars R R, which rest on friction-wheels C C mounted on the cast bed-frame A. The materials in requisite proportions are delivered to hopper H and supplied with water through pipe W. The material passes through collar D into B, and is thoroughly mixed by the constant revolution of the box turned by a separate engine (not shown) that is geared directly to spur-wheel G. As the weight increases in the hopper the plastic concrete is forced out of the end E, which delivers it ready for use to the buckets, one of which is always being filled. One of these machines has a capacity of 150 cubic yards of concrete in ten hours, and on one occasion two machines delivered 431 cubic yards in 10 hours.

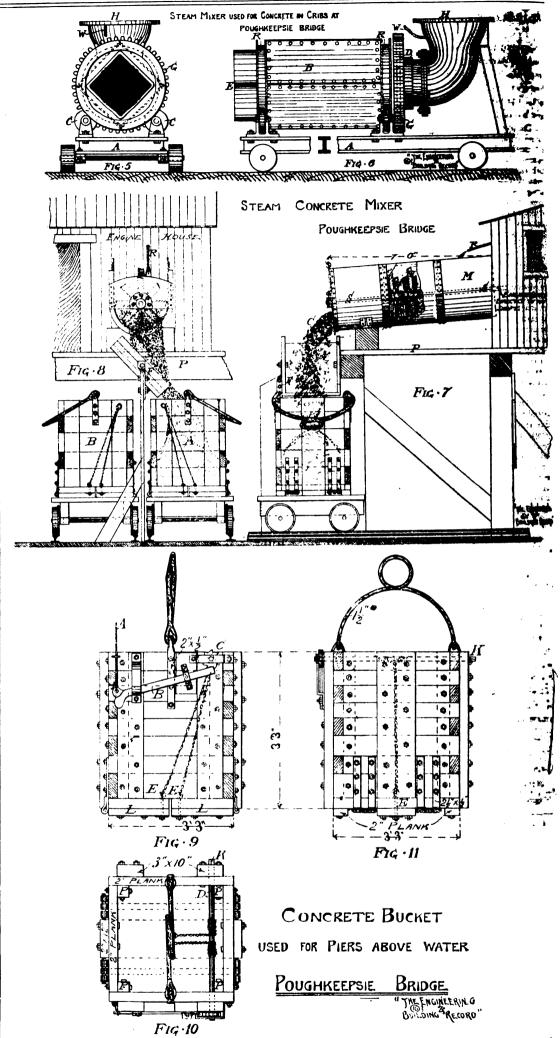
About 12,000,000 feet B. M. of timber was used in the cribs, and bolted together with 1,200 tons of iron.

The pier masonry is bedded on the caisson floors from 10 to 15 feet below high-water line and is about 30x90 feet on the base and 40 feet high. The piers are faced with dark coursed limestone from the quarries at Sandy Hill, N. Y., and capped with dressed coping of the same, with cut stone beds for the tower pedestals. The facing stones were laid in cement mortar, 1 part cement and 2 parts sand. The anchor-bars were placed before the piers were carried up, and solidly built in as work progressed. The face walls are one stone in thickness, and the interior chamber is filled with concrete in proportions of 11/2 barrels Portland cement to 1 cubic yard of gravel well packed and rammed. The stones in the concrete did not exceed two inches in any dimension, but large irregular blocks were bedded in it throughout.

Figures 7 and 8 illustrate the concrete-mixers for the pier work.

The steam-mixer M is placed on an elevated platform P, upon which the materials are delivered. On the deck below a tramway leads from the foot of the hoisting derrick, and terminates in a Y, which permits a second car and bucket B to be presented before the first one, A, is quite filled, so the mixer can work continually. Water is supplied to the mixer by pipe R, and laborers constantly shovel the sand, cement and stone into the iron trough M whose ends are closed, and whose cylindrical bottom surface is just cleared by the inclined blades W W that are fastened to the shaft S, continuously driven by an engine geared to its upper end. The materials are supplied at the upper end of M, and thoroughly incorporated by the agitation of the blades before they are ejected at C. The delivery is in a constant stream, that is caught on the pivoted chute F and deflected into either bucket A or B This mixer has a maximum capacity of 100 cubic yards of concrete in 10 hours; it is driven by a separate engine, and even when working up to its capacity requires but few attendants. One hundred laborers would be required to make the same amount of concrete by hand in a less satisfactory manner,

*No. 1 of these articles, containing the General Description and an ecount of submerged work, appeared in our issue of March 3.



The buckets used for carrying the concrete from mixers to the pier hold about one cubic yard, and are so convenient and well made that we show them in Figs. 9, 10, and 11. They are built of oak plank, the sides and bottom two inches thick, well reinforced by batten cleats, and bolted to corner posts P P. The hinged bottom is in two leaves, L L, having eye-bolts, E E, through the free edge. Chains through these eves are fastened to the shaft D, which is turned by a crank at K, and winds up the chain, closing the leaves L L. The shaft is secured at any time by the

ratchet C and pawl B. After being filled the bucket is received by the derrick and swung over the place where its contents are required. The cord A is then pulled and disengages the pawl B, the shaft being released, the chain unwinds, and the leaves L L open and discharge the concrete; the bucket is lowered, the chain rewound, and it is again ready for filling.

The stone, cement, etc., were handled in the usual manner by mast and boom derricks run by steam-engines, of which a considerable number were used by the contractors.



EIGHTH ANNUAL CONVENTION OF THE AMERICAN WATER-WORKS ASSOCIATION.

(Continued from page 315.)

WATER-SUPPLY SOURCES AND TREATMENTS.

By J. T. FANNING, President of the American Water-Works Association.

Nutural Clarification .- The waters from mountain streams among the granite hills, though unfortunately within the reach of so few villages, are the purest among the sources of water supply, and are also the clearest except in floods.

Then next, the waters from the gneiss, trap, and other unstratified hills, and then upland lake waters are excellent, but these when gathered in reservoirs exposed to the light may be as prolific producers of tiny plant life as a newly-fertilized lawn.

We must store them in darkness and keep their temperature law or they will require artificial clarification.

ature low or they will require artificial clarification.

As the hillside streams and waters of the upland lakes abrade their channels and shores and receive the drainage of the forests and swamps, they take in mineral and organic sediments, and on reaching the lower valleys as large rivers there comes the necessity for their artificial clarification in some degree to fit them for supplying potable water. For villages and towns not on the upland, clarification, in some form, is a subject of most vital importance.

Along the bases of such hills as furnish the best surface

Along the bases of such hills as furnish the best surface waters are found the best examples of naturally clarified waters in their clear flowing springs.

The villages and towns of the midlands and plains have to create artificial springs to receive the advantages of natural clarification. This they may do in various forms of driven and other wells, infiltration tanks and galleries, but these for reasonable success must be in silicious sands or corese grantly that the flow may be apple and the or coarse gravels, that the flow may be ample and the mineral impregnations slight. Large proportions of soluble minerals in the soils lead to undue hardness in the water and render them unavailable for infiltration pur-

poses.

The areas of the water-sheds of the wells and galleries are controlling conditions, for the rainfall upon each water-shed area, less evaporation, is the true source of supply, and the uniformity of continuous flow is governed by the storage capacity of the soil and the rate of percolation to the given well through its sub-strata. If the gallery and sources of flow are shallow, then the water-shed must be closely contributed lest some organic taints be corrected.

be closely scrutinized lest some organic taints be carried down in solution from the surface.

Three principal conditions of successful infiltration of potable waters are: (1) Sufficient water-shed; (2) pervious receiving and conducting strata; and (3) insoluble storage

The most successful infiltrations for supplies of towns

The most successful infiltrations for supplies of towns and the large villages have been into relatively long and narrow galleries, and the values of their waters have varied according to the nature of the filtering soils.

The mineralogical conditions suggested above indicate in a general way where infiltration supplies may be sought with a reasonable degree of success. In their most successful use, about one-tenth of an acre of bottom surface in the gallery has supplied 1,000,000 gallons of water, requiring a gallery say eight feet wide and 540 feet long.

Granular sands offer the best possible conditions, and are sometimes available in the islands and shores of lakes and streams. Without the most favorable conditions, extent of gallery required makes infiltration unavailable to

and streams. Without the most favorable conditions, extent of gallery required makes infiltration unavailable to the medium-sized and larger cities of the valleys.

Deep-Well Water-Supplies.—Different systems in the construction of water-works have their respective waves of popularity. Just at present driven and drilled wells are attracting much attention, and all over our land prospectors are drilling deep for water, oil, and gas. Discussions of the "germ theory" of disease have been frequent of late, in which drinking-water from surface sources is assumed to be sometimes a conveyer of micro-organisms. assumed to be sometimes a conveyer of micro-organisms, that become lodged in the human system and induce various fevers and epidemic diseases. These have had much influence in leading individuals and villages to seek their water-supplies deep below the habitations of the protowater-supplies deep below the habitations of the proto-phyta and protozoa, and there is a popular notion in most localities that if a well is only drilled deep enough any-where a flow will be the reward as copious as when Moses smote the rock in the wilderness. There are localities where an artesian flow of water or oil is a probability, and other localities where the financial expenditure for a test is unwarranted. An intelligent geological study of any locality is the basis of a prediction whether granite, lime-stone, sandstone, shale or coal will be found in the sub-strata, and likewise it is the basis on which to found the prediction of the presence or absence of water or oil that

strata, and likewise it is the basis on which to found the prediction of the presence or absence of water or oil that will flow with sufficient volume and pressure.

An invariable condition for the production of a flowing well is an inclined or pervious stratum overlaid by an impervious stratum, and usually an impervious stratum underlies the pervious one. To illustrate these conditions on a minute scale take a china saucer and cover its interior with a thin layer of sand, and then place within it another smaller saucer covering the sand. Now if the sand between the saucers be filled with water to the brim of the inner saucer, and a fine hole be drilled through the lower portion saucer, and a fine hole be drilled through the lower portion of the inner saucer, then an artesian flow will be the result. Substantially this condition is often found in the sandstone regions, and where an extensive coarse granular stratum

of stone or of gravel lies inclined between fine-grained stone or clay, and has a broad outcrop at its highest ex-posed edge, a copious supply of water will be found, and the volume of water it can continuously supply will always be dependent on the replenishing rainfall supplying its

higher portion.

This condition cannot be anticipated where the igneous rocks are near the surface, or where the rock is fine-grained as in limestone or slate, unless they are badly shattered. Potable artesian water can rarely be anticipated in the bituminous belts, now well defined in the settled portions of our continent, and usually well outlined in the eological maps of our States, and only in these latter may

geological maps of our States, and only in these latter may oil and gas reasonably be anticipated.

As with the gallery supplies, so with the artesian supplies do we find the extent of available water-shed to interpose a limiting condition, and rarely can the medium and larger-sized cities of the valleys find an ample deep-well clarified supply by searches among their substrata.

If they will have clarified water they must employ some form of artificial clarification to improve their available surface water-supplies. We have already alluded to the usual necessity for such clarification, but when the necessities that grow out of our physical requirements are opposed by municipal financial weakness, the weakness usually proves the stronger.

Artificial Clarification.—Sedimentation, precipitation, filtration, and aeration of water-supplies are subjects that have been ably discussed in these meetings and some valuable papers relating to these topics are ready for presen-

uable papers relating to these topics are ready for presentation during this annual gathering, so that a mention in outline only is proper at this time.

As in natural clarification so in artificial the chief objects

are the removal of:

1. Mineral matters in suspension, consisting chiefly of silicious and caicareous sands, marls, loam, and clay.

2. Dissolved organic matters in suspension, both vegetable and animal

3. Live organisms, both vegetable and animal, and the dissolution of the organic and mineral solutions in the water, including the removal of acquired color and the restoration of a due proportion of oxygen.

As incident to the study of clarification of waters, attended to the study of clarification of waters.

tion has been drawn to the forms of aquatic life that lead to the chief necessity for such treatment. We have observed that the clear mountain streams if held in storage, and we may add also pure waters generally if stored with light and summer warmth, develop certain of the fresh-water algae with rapidity, and of such plant life the desmids

They are harmless while living, but if abundant give

odor and opaqueness to the water as they decay.

The oscillatoria and confervæ incline to waters with calcareous impregnation and are indicative of hardness to

The bacteria are of the lowest group of algæ and incline The bacteria are of the lowest group of algæ and incline to waters having organic pollutions, and these are the microscopic plants we are taught most to fear. Their presence has been believed to be invariably associated with the putrefaction of decaying animal and vegetable matter, and their tenacity of life is remakable.

Dr. Cohn distinguishes two classes of them present in the ferments of putrescence, also a color-producing class and a disease are decing class.

and a disease-producing class.

The term "microbes," as used in our literature of water

analysis, includes both the micro-algæ and micro-fungi.

The biological investigations of public water-supplies includes the study of the characteristics of the microbes and of their effects when introduced into the human sys-

Among the lowest forms of aquatic animal life the spongilla has proved most offensive in the odors of our natural lake and impounded waters.

The tiny infusoria and polyps sometimes develop in superabundance and in their decay we have an objection-

able water pollution.

The pollution most apparent to the naked eye other than mineral sediments are the washings of forest and field, and the pollutions harboring most dangers are the several classes of sewage in process of dissolution and in solution.

Dilutions, but humanity has counteracted the remedy where it has built its gardens, factories, and towns more numerous and dense as the water grows slacker along its

course through the valleys to the sea.

The remedy which has been most extensively tried and most discussed in these meetings is sand filtration, and you are familiar with the construction of sand-filters. Among their best surfacing materials are fine-grained silicates of soda, alumina, potash, lime, etc., and with these are mixed at times granular iron and especially the magnetic carbide of iron and charcoal, and also prepared charcoal plates have been used.

These filters do excellent service if they are cleaned as

often as excellent service demands, which is very often for a turbid water, and if not duly cleaned they may clarify for a time, in lessening degree, until so foul with inter-cepted matter as to finally pollute the flowing water. Uncleaned and unaerated filters, public or private, are an abomination and a danger.

Sand-filters for public supplies require about four-tenths

of an acre of surface for each million of gallons per diem, and cost from fifty to eighty thousand dollars per acre for

original construction.

In the Northern cities the formation of anchor-ice on the surface of the sand and ice on the surface of the water interferes with the use of such open filters, and under favorable conditions the cost of filtration of turbid waters will not be much less than \$2.50 per million gallons of water

not be much less than \$2.50 per million gallons of water filtered.

The water ought, if possible, to be prepared for either public or private filtration by sedimentation if it carries much sand or coarse sediment, and by precipitation if it carries much fine clay or organic matter in suspension, mineral or organic matter in solution, or contains undue proportions of aquatic life, so that the filter may be relieved of excessive work of excessive clagging and pollution and of excessive work, of excessive clogging and pollution, and

of excessive work, of excessive clogging and pollution, and may be more easily cleaned.

Various precipitants are familiarly known and used in the processes of the arts, including salts of many of the metals; for instance, the sulphates and persulphates of iron, copper, manganese, zinc, aluminum, potassa, lime, and the chlorides and perchlorides of iron, tin, aluminum, mangangium calcium etc.

magnesium, calcium, etc.

Hydrated aluminum chloride and alumino-ferric compounds have had large application, and iron in filings, scraps and bundles of wire have been used in the purification of water polluted with vegetable organic matter in process of dissolution. Alum, lime, and iron have long been used for precipitants by families whose household supplies of water came from the clay-carrying rivers or the The sulphates of metals should, however, be cautiously

used where they are liable to contact with organic solutions, as they may be converted into soluable sulphides and dis-

used where they are liable to contact with organic solutions, as they may be converted into soluable sulphides and disengage sulphuretted hydrogen.

For the water-supply of a large city natural sedimentation, by rest of the water in settling basins, is a slow process, excepting for the coarse sands and heavier sediments, and requires large and costly basins in which to give the water six to twelve days rest before it is passed into the distribution system. With the proper and continuous use of precipitants as much may be accomplished in the same number of hours with great saving in cost of settling basins. Some of the precipitants have such affinities for organic matters in solution, and clays in suspension, that they almost instantly unite with them in coagulated flocculent masses, and are so concentrated that they have sufficient specific gravities to promptly start downward to the basin floor. In this movement of the flocculent material clarifying the water, the micro-organisms whose homes are in the midst of the organic pollutions are largely caught and borne downward also. In the coagulations are caught much of the impalpably fine organic matter and also the microscopic plants that give color or opaquenes or turbidness to the water.

At the same time the dissolving organic matters that are thrown down to await the periodical cleaning of the basin floor are rendered less soluble by their contact with the metallic salts which with exclusion from the air hinders their further dissolution.

The basin floors ought to have frequent and thorough

their further dissolution.

The basin floors ought to have frequent and thorough

cleanings.

Those pollutions in the waters that incline to resist precipitation are common salt, urea, ammoniacal salts. the alkaline earths, oils and refuse similar to that from gas-works.

As nitrates and nitrites are not fully controlled by the precipitants economically available, it is evident that precipitation is not a permanent guarantee against later putre-faction in the water if it is afterwards exposed to light and warmths of the summer sun, but the tendency is reduced by reduction of its cause.

Limy waters are alkaline, and there is more tendency to

active putrefaction in alkaline than in neutral or acidulated

Then we are to observe that the salts of iron if used in excess give colors to the water ranging from a greenish yellow to black; for instance, contact of iron with sulphur

gives a very dark from instance, contact of from with sulphur gives a very dark brown tint.

For water-supply clarification purposes, solutions of iron, aluminum, and calcium are the precipitants most economically and commercially available, and they are used alone or in varied combinations according to the characters of the sediments and pollutions to be acted

Very small proportions, comparatively, are effective, and the precipitants themselves are so completely carried down with the precipitated matters that bare traces of them remain in solution in the water.

Precipitation is an intermediate treatment between the

more common process of sedimentation and filtration, and it reduces materially the cost and time of unaided settle-

ment and of area of settling basins.

The precipitants are easily introduced, for they may flow from the faucets of one or more small tanks placed above the inlet stream of the settling basin, and thus be intimately intermingled with the waters.

In preparing an iron solution for clarifying the muddy water of the Mississippi at New Orleans our honored Ex-President has treated red hematite iron ore with hydro-President has treated red hematite iron ore with hydro-chloric acid, bringing it to 1.5 specific gravity, and his experiments showed that one part in twenty thousand parts clarified the muddiest water of the river, and neither hardened the water or left any trace of iron therein.

In every case where filtration is desirable preliminary preparation by precipitation is important, and in very many cases where sand filtration on the older system is, for financial or other reasons impossible pregipitation

many cases where sand filtration on the older system is, for financial or other reasons, impossible, precipitation will greatly improve the water-supply, and private filters on the services of such as can afford them can complete the process in the portion of their waters that are devoted to culinary and drinking purposes. With precipitation most waters will be fully fitted to enter the distribution-pipes.

After precipitation or filtration the waters should be kept well covered, and it is advisable that they be not kept on

^{*} Paper read before the Convention of the American Water-Works Association at Cleveland, O., April 17.

storage long enough for the slight remaining organic matters to again reach a condition approaching objectionable

Aeration, which will restore to the water an abundance of oxygen, is a most excellent treatment and antiseptic after precipitation and filtration. This is simply accomplished by forcing air into the pumping-main, or letting it be drawn into the suction-chamber of the pump, or into the supply-main from the reservoir.

Protection of Sources of Water-Supply.—Glancing over a map of the water-courses of our country we observe that a map of the water-courses of our country we observe that the towns and cities designated thereon are generally on the shores of these streams where the water-powers en-courage their growth or facilities for commerce will in-crease their wealth. The streams are the natural sewage channels of their water-sheds, and the water-supplies taken therefrom suffer according to the densities of the popula-tions and the extent of the manufactures along their

To prevent the establishment of mills, with their accompanying villages and gardens, along the rivers will to some extent interfere with local and national prosperities, and to entirely prevent the sewage of the upper villages from flowing down to the cities of the lowlands will to some extent interfere with natural laws.

we are not adequately handling our water-supplies by simply filtering out such pollutions as may chance to come down to us, but ought to begin our purification by attacking the pollutions at their origin, and providing that the sewage pollutions shall, so far as possible, be first spread broadly on the lands and there clarified by nature's pro-

Except in the bituminous districts and alkali plains we need rarely fear the mineral impregnations that nature sends down to our water-supplies. It is the decaying sends down to our water-supplies. It is the decaying vegetable organic, and especially the sewage organic matters that we have most to fear, and these multiply as the populations increase. It is in the midst of these that the disease-inducing germs chiefly generate. The desmids and bacteria of the purer waters, though frequently abundant, are not proved, nor yet fairly accused of endangering human constitutions, though absorbed through the medium

of water-supply.

The United States have now a total population of about sixty million people. Our past rates of decennial gain have

1840 to 1850, 35.81 per cent. 1850 to 1860, 35.57 1860 to 1870, 22.62 1870 to 1880, 30.07

The increase is most rapid in the towns and cities where the systems of water supply must be public in their char-

Eighty per cent. of the population of the State of Massachusetts, for instance, is already so grouped as to be pro-

vided with public water-supplies.

The rapid gain in population, the concentration of the people in towns, the increase in number of towns and in people in towns, the increase in number of towns and in new water-supply systems, all significantly suggest a united action looking to the matter of protection of the sources of additional water supplies for the existing towns, and of new supplies for future towns. This is a question that seems to loom up before us as though it might soon assume even national importance, and may, in the early future, tax the highest statesmanship and the most exalted wisdom.

The matter is worthy the earnest consideration of the American Water-Works Association.

QUESTIONS PREPARED FOR THE ASSOCIATION.*

I. WHAT warrant, based on just treatment of the public at large, is there for making a lesser rate for power than for consumption? For elevators and mechanical use than

for culinary purposes?

Mr. Ayres—We can pump and sell 1,000,000 gallons cheaper than 500,000 gallons.

Mr. Denman-In some cities discrimination is made in the price of the same amounts of water used for elevator

and hotel purposes.

Mr. Richards—With us every consumer has a meter and pays the same rate. Small consumers are no better able to

pay than wholesalers.

Mr. Troy—We have adopted a sliding scale, reducing

Mr. Troy—We have adopted a sliding scale, reducing for wholesalers.

Mr. Tubbs—The prime motive of water franchises is to insure the provision of a supply for sanitary and domestic purposes, not for hydraulic canals or manufactories.

The price should not be reduced for elevators or mechanical purposes, but on the contrary, any benefit of low rates should be secured to the householder.

Water companies are usually allowed to take water from private sources, often damaging the property and allowing them to become hydraulic suppliers is an injustice to riparian owners.

mr. Denman read a list of three classified rates from many cities showing a discrimination in favor of large consumers.

Mr. Decker was opposed to differences in price and instanced several cases where elevators used less water than domestic consumers and paid about 25 per cent.

less.

Mr. Dunham—Charge might be made according to service rendered; for example, discriminate between a livery stable that is benefited by a high pressure and a boiler that is not.

* Discussion before the eighth annual meeting of the American Water-Works Association at Cleveland, April 18, 1888.

In a certain city there are two systems, one of high and the other of low pressure service.

Elevators use from the former and discharge into the

latter system and are charged only two-thirds the amount they would be if they discharged into the sewers.

Some further discussion followed on this question and was concluded by the suggestion that if manufacturers were charged a price higher than the cost of pumping for themselves would amount to, they would not lend any support, and that the water-works would be worse off than if they had reduced their rates enough to secure their cus-

tom.

II. Where water is sold by meter under a schedule of rates, has a consumer a right to sell to his neighbor without consent from the company?

Mr. Decker—No; the company has an exclusive franchise and the consumer buys only for specific purposes.

Mr. Richards—We allow several consumers to use the

same meter, for which a certain minimum rate is charged. Mr. Dunham thought it fair if a certain minimum rate was maintained.

President Fanning suggested a comparison of the rules of different companies.

Mr. Troy—We give no water except on the presentation of a permit from the water-works superintendent.

Mr. Denman—If I buy water and pay for it, it is mine and I have the right to use it as I please; but if a man is using water at the maximum rate, and supplies his neighbor and divides the bills with him, he drops to a smaller rate. Is this right?

Mr. Garrison—We have the gravity system and were not allowed to introduce meters when we tried to do so. Motors, engines, etc., received special rates, but brewers were driven entirely out of business. When meters are used special contracts should be made

on sliding scales and consumers allowed to resell if they

choose.

Mr. Young—The question is one of private property, bought for specific use from which it cannot be diverted.

Mr. Allen-Such retail business by consumers interferes with the company's franchise.

Mr. Troy—We had a case of a man using water through

which he supplied his neighbors free of charge. He refused to stop when notified to do so, but the matter being arbitrated was decided against him.

Mr. Molis—We allow any number of consumers to use

the same hydrant and decrease the individual rate as their number increases. This greatly stimulates the use of water and is a popular measure; in a year or two the joint con-sumers apply for separate hydrants and we make money by

it. Our net income is about \$12,000 a year.

III. In case of contract to furnish water for a specified sum per annum, the maximum amount of water permitted to be used being also defined, has the consumer the right to sell or dispose of the unconsumed balance? This question was considered too much like No. II to merit discussion in the limited time available

ONE PHASE OF THE PROBLEM.*

THE problem is to supply pure water. The phase presented is from a point of view which is not elevated nor lighted up by much wisdom.

Water, not as rivers furnish it, which in many places is through pipes as it has been for hundreds of years 'for all purposes.' To purify the water for a great city is a very difficult matter.

There is no need to remind you that we all look to the

people for support and assistance in these important questions of method and expenditure. Their opinion and action

In the last few years, during which so much has been discovered that calls for prompt and decided effort, the impression that water is free and not a salable article has been largely removed, but in its place we have the no less dangerous notion that in all places a certain definite sum of money should pay for a certain definite quantity of some kind of water

Men have sought for an "average rate," as if it were a lucky number that once known would secure permanent happiness. Men have pointed with pride to the low rates in their cities when those rates should have been looked upon as a disgrace. Councilmen and others with the interest of the people at heart have assumed in establishing rates that unless the rate was as low as in some neighborrates that unless the rate was as low as in some neighboring city—where the conditions were entirely different—people would be driven away from their town or not be attracted to it, and to-day such notions are common.

They are all wrong. We might as well stop the trans-

attracted to it, and to-day such notions are common.

They are all wrong. We might as well stop the transportation of grain, and then, by means of adulteration, make the price of flour uniform all over the country, the same in New York and Minnesota.

Wholesome water should be made the one and only basis, and the rate charged should be determined by the cost of procuring it, and there is no city in our country where cannot afford to pay that rate better than they can

afford to pay any rate for unwholesome water.

We have an illustration in our midst. Six thousand families in Cleveland are using well-water where wholesome water is convenient. But how was it found out that there are six thousand? Why is the fact published and known all over the country? Why are steps being taken to make that number less? It is simply because the intel-

*Abstract of paper read by Member H. F. Dunham before the convention of the American Water-Works Association at Cleveland, O., April 17, 1888.

ligence of the present is demanding that after the best has been provided it shall be accepted in order to preserve To demand that the best possible shall be provided for the same purpose is no less a duty.

THE KANSAS CITY QUESTION.

MR. A. N. DENMAN, of Des Moines, Iowa, defined the subject as relating to the rights of plumbers to tap watermains, and read a clipping from a Kansas City newspaper of a decision in an injunction suit in which a water-works company enjoined a firm from touching or repairing the plumbing used in the system for the distribution of water about Kansas City without a license from the water-works. The judge decided that the water-works company had no right to compel a plumber to be licensed by them to repair any plumbing work in private property, but decided that a plumber would have no right to repair any mains or pipes in the streets. The injunction was denied.

Mr. Denman had secured the opinion of two attorneys

on the decision, which was to the effect that under the ruling plumbers could not tap water-mains without the permission of the water company. Plumbers were required to observe all reasonable regulations. Mr. Denman discussed the legal phases of the problem, and expressed the belief that the code of morals concerning water was different from all others. He considered the Kansas City decision of interest, because it was probably the first on record concerning the relations between plumbers and water companies.

The water company should know in advance of contem-The water company should know in advance of contemplated connections and the required service. It should be able to make suitable preparations for it, and provision that existing requirements should not be injuriously, affected by new and arbitrary ones, and it should always know what service was performed by every connection from the mains. These things were impossible if every one might have unrestricted license in the use and connections of every branch taken from the mains. But on the other hand the piping and fixtures in a man's own house are his private property, and it seems as if he should have the right to arrange them to suit himself.

Q. Would not the difficulty be met by requiring applications from property-owners for the water connections?

A. Yes; but the cost would be excessive, and the rates

in our town being fixed by law cannot be raised to cover

the expense.
Q. Why not make special contracts with each consumer, and permit no one but water-works employees to tap the

A. We have no trouble with our taps, only with extensions. Consumers are frequently irresponsible, and often Q. Can you not then prosecute them for tampering with

the water-works?

A. Yes; but the cost will be excessive, as in all these cases, where we should have to pay fees of \$25 to recover damages not above \$3 or \$4, and would be laughed out of

FEED-WATER HEATERS AND CONDENSERS.

My experience is that an economy of about one per cent. My experience is that an economy of about one per term, of the fuel used is gained for each 10° that the feed-water is heated. Condensers should be run pretty cool. If we sacrifice economy of engines to economy of hollers we can spare a few inches of vacuum. Under proper conditions a feed-water heater is beneficial between the low-pressure cylinder and condenser, and a second heater for exhaust-steam from pumps, etc., would give best results. It is questionable whether condensers are beneficial for pump-ing-engines of a million gallons capacity or less, but for engines of three million gallons capacity and upwards independent condensers and attached air-pumps are desir-

I prefer attached air-pumps, especially for reservoir

Surface condensers should be used on high-service plants where water has been once pumped; it can be advantageously placed in the suction-main, where it becomes simply a chamber full of steam-pipes, and has the use of all the water without any cost or waste. I have seen it so placed produce a vacuum of 28 inches; then by heating the feed-water the most beneficial results are gained.

The use of surface condensers often causes trouble in the boilers with cylinder oil, which cakes and produces bagging of sheets. This is easily avoided by straining feed-water

The use of high-class machinery and competent engineers and attendance will always be found most econom-

DISCUSSION.

Mr. Decker — Assuming a 1,000,000 gallon engine, steam-pressure of 75 to 80 pounds, etc., should we for reservoir service use a condenser?

Mr. Hague—Yes; but I referred to direct service.
Mr. Decker—In pumping lime and alkaline water would

advantages of evaporation overcome loss of heat?

Mr. Hague—I would condense and heat both, having a direct acting feed-pump, but would hesitate to sacrifice the vacuum to heating feed-water.

^{*} Discussion at the eighth annual meeting of the American Water-Works Association at Cleveland, April 18, 1888.

† Abstract of informal paper read at Cleveland April 19 before the eighth annual meeting of the American Water-Works Association by Member Charles A. Hague.



Mr. Richards—How is the oil-strainer made? Mr. Hague—In many simple ways, as by filling a vessel with straw

Mr. Dunham—Is there any way to prevent the noise made by free exhaust-steam except by use of a condenser?

Mr. Hague—No.
Mr. Gerecke—Atlantic steamers use an apparatus for removing oil from exhaust-steam before it leaves the condenser.

Exhaust-steam injectors are now used for returning it in high-pressure engines to feed the boilers. The arrangement works nicely and obviates noise and trouble.

Mr. Hague—I think its success would be doubtful

with low-pressure engines.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, penng governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

BALANCED LOW-PRESSURE CRANE.

In this crane it will be observed that the bar on which the trolley travels has a vertical motion giving the desired lift, and that it is supported by four chains, two at each end, leading over sheaves to the pressure-cylinder at the back of the crane-post. The cylinder and trolley-bar thus counterbalance each other, so that all the pressure is utilized in lifting the load, and the four chains not only give at all times a square pull on the cylinder, but prevent any material damage from the breaking of any one chain.

The cylinder is guided by the stationary piston-rod, which is made hollow, and serves to admit to the cylinder the pressure which is conveyed to the crane through a hollow gudgeon at its foot provided with a stuffing-box; the supply-pipe and operating valve are shown in the foreground. Connection can also be made through a short length of pressure-hose, but in that case the crane cannot be turned more than one revolution in the same direction.

When pressure is admitted it acts on the lower head of the cylinder to force it down, thus raising the trolley-bar with its attached load; when released the load preponderates or the bar can be weighted to descend unloaded.

If through lack of head-room or other cause it is necessary to have the trolley-bar descend nearly to the floor, it can be accomplished by sinking the lower part of the cranepost in a pit or by attaching sheaves to the top of the cylinder, which doubles the travel of the trolley-bar.

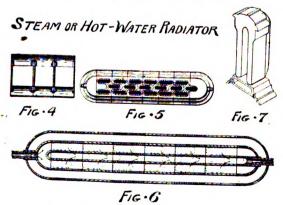
Steam-pressure can be used direct or through the medium of some liquid on which, in an intermediate chamber, the steam presses, the liquid returning to the chamber when the steam escapes.

Petroleum forced by compressed air has worked very well. The advantage of fluid-pressure is its steadiness and of course where hydraulic power is available it can be used direct.

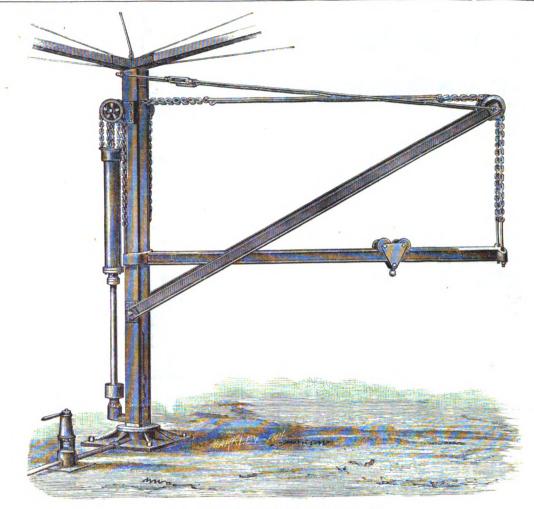
These cranes are made by Craig Ridgway & Son, of Coatesville, Pa.

A SECTIONAL STEAM OR HOT-WATER RADIATOR.

THIS radiator is composed of separate transverse sections, of which any number may be connected together that may be necessary to give the desired size.



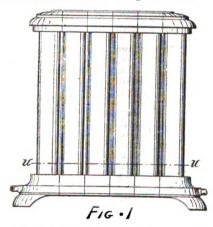
Fach section, Fig. 7, is a single casting composed of a portion of the base and a flattened three-lobed radiating tube, as shown in Fig. 5, which is a section on line u u, Fig. 1. The hot water ascends through the outer lobes and descends through the inner one, which projects between the outer lobes of the adjacent section, by which arrangement it is claimed that the radiator is rendered more



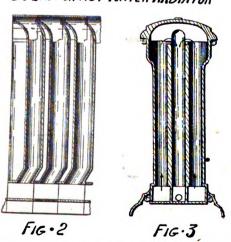
BALANCED LOW-PRESSURE CRANE.

compact while at the same time the radiating surface is increased.

A side view of the complete radiator is shown in Fig. 1, while Fig. 4 is bottom view of three sections, showing method of bolting together. Figures 3 and 2 are transverse and partial longitudinal sections respectively, while Fig. 6 is a horizontal section through the base.



STEAM OR HOT-WATER RADIATOR



The direction of the hot-water circulation is shown by the arrows. When used for steam all the internal divisions are omitted, and the three passages in the tubes are thrown

The patentee is Alfred Catchpole, of Geneva, N. Y.

REVISED ESTIMATES FOR PROPOSED BROOK-I.YN BRIDGE TERMINALS.

MR. A. M. WELLINGTON having assailed in the public prints the estimates submitted by Mr. C. C. Martin, Chief Engineer of the Brooklyn Bridge, which the Committee on Terminal Facilities referred to in their report printed in our issue of April 21, these estimates have been revised by Mr. G. Leverich, one of the engineers of the bridge, with the following results: Real estate, \$2,698,000; stations, \$2,720,600; cable-driving plant, \$482,100; rolling stock, \$522,000; storage platforms, \$143,750.

The amount of the approximate estimate presented April 7 last is \$6,602,250, or \$36,400 greater than that of this estimate as revised: the difference consists of an increase in the items for cable-driving plant of \$7,000, for rolling stock of \$3,200, and for storage platforms of \$8,750; and a decrease in the items, for real estate storage yard of \$4,250, and for stations of \$80,000. These changes are due to a more careful examination into the probable costs than could be made when the first estimate was prepared.

In submitting these estimates Mr. Martin states that he considers the "total amount quite too small." He states that the original estimates were made reluctantly, as the engineers were convinced that as an engineering device the "'simple circulating system' was both unsafe and impracticable." Regarding the estimate for real estate to be acquired, which it has been alleged was extravagant, it should be said that the estimate was made by Mr. T. H. Terry, a real estate agent and professional valuer, of New York City, who was especially employed for this purpose.

THE WASTE OF CROTON WATER.

AT a recent meeting of the Board of Aldermen of New York City a communication was received from Mr. Samuel A. Strang, of that city, recommanding the use of the Deacon water-waste detector, which he estimated would save the city \$100,000 a year, and enclosing a circular descriptive of its use and efficiency.

The communication was referred to the Committee on Public Works, who were authorized to investigate the waste of Croton water and the proposed remedy therefor.

NEW YORK MUNICIPAL BUILDINGS COMPE-TITION.

MESSRS. R. M. HUNT, Prof. W. R. Ware, and Richand Upjohn have been selected as the expert advisers to the Sinking Fund Commissioners on the award of prizes for plans submitted in competition.





PLANT OF THE BOSTON HEATING COMPANY No. II.

(Continued from page 316.)

REFERENCE to the accompanying illustration, Fig. 1, may aid an understanding of our system. At a central station a number of boilers are located, exemplified in the illustration at A. From the boiler, A, proceeds a pipe, C', to a pump B. This pipe is attached to the suction end of the pump, and consequently the action of the pump withdraws the water from the boiler. Proceeding from the discharge end of the pump a pipe, C, extends through the streets and, returning to the central station, enters the boiler at C". As soon as the pump is set in operation the water flows out of the boiler by the suction-pipe C, and is forced around through the streets and back again into the boiler by the pump. If, during its passage, no water is taken from the main every stroke of the pump, withdraws from the boiler and returns to it again an equal quantity of water. In reality, the office of the pump, B, is simply to sustain a continuous circulation through the hot-water

Directly beneath the hot-water main, C, there will be seen a pipe, D, which, in the station, terminates in the tank, D'. This second main collects the water as fast as it is used and cooled and returns it to the station, from which function it derives the name of the return main. As the return main empties into the tank, D', all the water cooled and carried back to the station is delivered into this tank, from which a second pump, D', draws the water and forces it back into the boiler again, to receive a fresh quantity of heat and be ready for another journey through the supply main. (The actual arrangement of the central station is shown in Fig. 2.)

From point to point along the main small pipes, c', extend to the curbstone and terminate in the service-box. N. The pipe in the service-box is so arranged so as to enable a single box to supply three houses. This is accomplished by capping the end of the pipe with the three-way tee, to which are attached three asbestos cocks. From this tee in the service-box small copper pipes, O, extend into the adjacent houses, furnishing them with a supply of water. Directly beneath the supply-pipe, c', is a similar though larger pipe, d', to collect the cooled water from the houses and conduct it to the return main. This pipe, d', also enters the service-box, and there, by a similar arrangement of tees and cocks, is enabled to receive the water from the three buildings which the hot-water pipe directly above

During the past three months we have excavated a trench some two and a half or three feet wide, and varying from two and a half to seven or eight feet, having an average depth of four feet. The trench has been excavated between the street corners. Along the bottom of the trench we have spread a uniform layer of concrete eight inches in thickness, made of one part of cement, two parts sand, and two parts broken stone thoroughly rammed into place. Once in about fifteen feet a brick pier has been introduced into the concrete and solidly embedded therein. On this brick pier has been placed an iron construction called a bracket. (See section of conduit, Fig. 3.)

The bracket consists of a solid, arch-shaped casting, supporting a roller covered by a cap. The office of this roller is to carry the four-inch supply-pipe and allow it sufficient ease of motion so that it may readily expand and contract under the variations of temperature, while the cap surrounding the whole confines the pipe sufficiently in its place so as to maintain it in a fairly straight line and prevent it from becoming in any way displaced. The whole bracket stands on top of the brick pier, while directly underneath the arch of the bracket a second roller, placed on a small iron stand, is seen, the office of which is to support in a similar manner the eight-inch return pipe, and to permit of perfect freedom for expansion.]

It would seem that there was quite a disproportion between the supply and return pipes. The supply pumps at the station taking their suction from the boiler are able to maintain through the small supply pipe a rapid current.

We expect to carry a circulation, depending on the demand on the system, of from five to ten feet a second. By means of the pumps this forced circulation is easily accomplished. While a small pipe for the supply adds to the frictional resistance offered to the pumps, the radiating surface is largely diminished, the cost of the pipe is much decreased, and the ease of construction is greatly facilitated. In the return pipe, when the water is to come back to the station by gravitation alone, it is necessary to decrease the frictional resistance as much as possible to afford an abundant chance for the water to run back easily and freely, no matter whether the discharge from the houses is regular or irregular. So we have for the return pipe an eight-inch pipe, and for the supply pipe a four-inch.

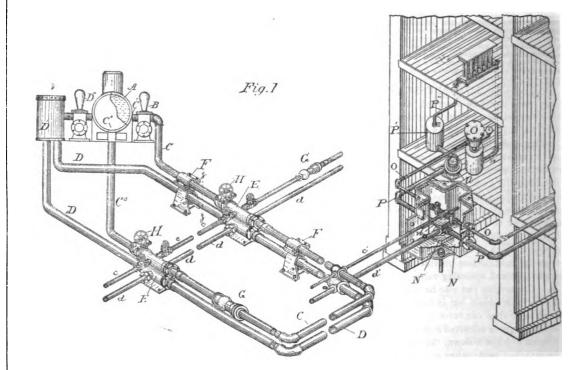
(To be continued.)

(To BE CONTINUED.)

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas Light Company
April 28	24.92	20.39	23.03	30.19	29 14	24.48	31.72



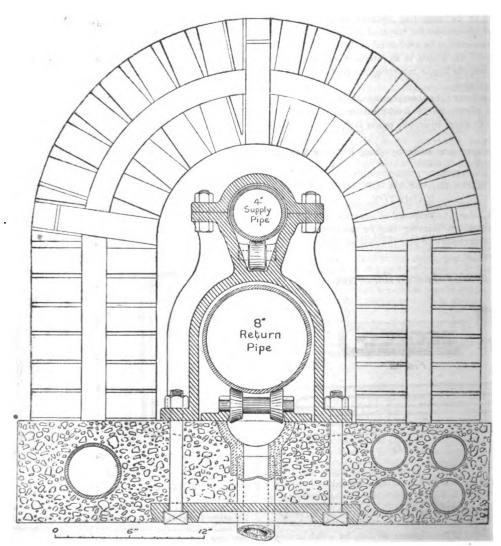


Fig. 3.—SECTION OF CONDUIT. Digitized by Google

barrel A A. The entire supply may be shut off by clos-

DOMESTIC ENGINEERING, ETC., IN THE CEN-TRAL TRUST COMPANY'S BUILDING, NEW YORK CITY.

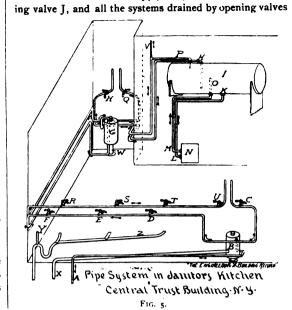
No. II.

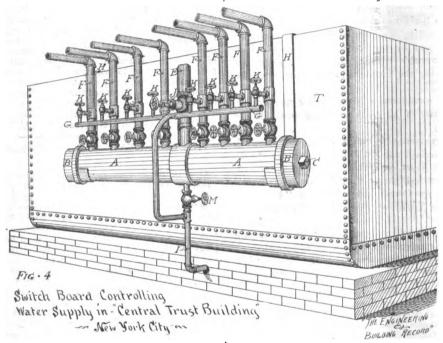
(Continued from page 317.) PLUMBING.

ALL the water-pipes are brass, tinned inside, and polished or tinned outside, and all their metal connections and fixtures are brass or copper of approved design, in accordance [with the general plans. Among the special features of interest in this work a very convenient one is the switch-board controlling the water-supply to the faucets in the offices and other apartments. These faucets are arranged on the different floors so as to be in nearly the same vertical planes, each of which forms a separate system supplied by one line of 1-inch pipe.

Figure 4 shows the ingenious device by which water may be admitted to or excluded from any one of these systems independently of the rest.

The arrangement is located in the basement near the engine-room, and is conveniently suspended by hooks H H from the engine tank T, of which, however, it is entirely independent.





The water is pumped directly from the cellar tank or street main to the gravity tank near the roof (see Fig. 3, page 317), and thence brought by pipe E to the barrel A A, which is made from 8-inch galvanized-iron pipe closed by 8-inch caps B B, that are furnished with the square bosses C C, to provide hold for wrenches to screw them up. F F, etc., are the pipes supplying the different lines. G is a drip-pipe draining them; I is a drip-pipe draining the L L, etc. If repairs or any other consideration require the exclusion of water from any room or fixture, the linepipe F, to which it is connected, is shut off by closing its valve K, and drained by opening L, without interfering with any other line.

Fig. 5 is a diagram of water-pipes in janitor's kitchen, which was originally designed for use as the kitchen of an employees' restaurant.

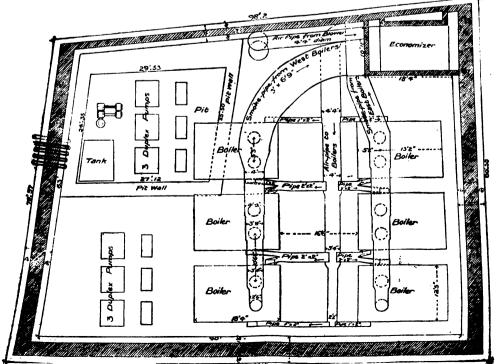


FIG. 2.—PLAN OF THE CENTRAL STATION, BOSTON HEATING COMPANY.

The cold water enters at A, passes through grease-trap B, and branches to supply sink-faucet C, while the main pipe supplies wash-tub faucets D, E and F; then crosses the side wall of the room and passes through grease-trap G, and, branching to sink-faucet H, is continued to J, where it enters the boiler I, and, leaving it at K, is admitted at L, to the water-back N, where it is heated, and. rising through pipe M, re-enters I at O and is drawn off through pipe P, which branches to sink-faucet Q, and thence continues behind trap G across the side wall and to the wash-tub faucets R, S and T and the sink-faucet U. V is a pipe connecting with the roof tank. Z is the waste-pipe for wash-tubs, and is vented by pipe Y. X is the waste from trap B, and W is that from trap G. The next article of this series will show the special fittings of this kitchen.

(To BE CONTINUED.)

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

LEAD BURNING VERTICAL SEAMS.

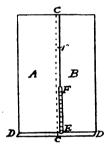
APPLETON, WIS., March 30, 1888.

SIR: I am a subscriber to your paper and would be signal to get a little instruction from some one of our practical lead burners in regard to burning upright seams, as I find it a rather difficult job to do. I have a machine for that work and can burn the flat seams satisfactorily, but the upright seams are what bother me. Any information in regard to the some would be thankfully received.

Yours truly, H. N., Plumber.

[In reply to the recently published inquiry from "H. N." as to how upright seams should be burned, we have received the following communication from a practical lead burner, who is especially experienced in the matter

It requires experience and skill to burn vertical seams. Allow the tank sheets to lap about one inchand clean the inside one at least half an inch back from the edge of the outside sheet. Clean the outside sheet or lap the same



distance from the edge on both sides. Then commence at the bottom of the tank and burn upwards, using the outside lap for material to build up the seam. In the sketch A is the outside sheet from which the seam is to be built, B the inside sheet, D D is the lap at the bottom of the tank. The dotted line C C shows the edge of inside plate B, and E F is a completed portion of the burned seam, commenced at E.]

WHO SELLS CLAMOND OR WELSBACH IN-CANDESCENT GAS-BURNERS?

NEW YORK, April 27, 1888.

SIR: In answer to the above inquiry in your issue of April 21, I would respectfully refer you to the Welsbach Incandescent Gas-Light Company of Pennsylvania, 122 South Twelfth Street, Philadelphia.

Yours respectfully, W. S. BACOT.

PATENTS ON GREASE-SEPARATORS.

St. Paul, Minn., April 30, 1888.

St. Paul, Minn., April 30, 1888.

Sir: On page 224 of your "Steam-Heating Problems" you say: "On page 171 will be found a description of an apparatus used to separate oil from exhaust-steam, and which may be used by any one, as it is not patented."

We have a party in this city who claims a patent on this: are we safe in putting in same, as you describe, in our steam plant without regard to him? Yours truly,

ECONOMY STEAM-HEAT CO.

[The apparatus as shown on page 171 of "Steam-Heating Problems" was designed by Mr. William J. Baldwin, M. E., for the Manhattan Company's and Merchants' Bank Building in New York, and was never patented by him. What the claims of patentees are in the matter of separation of oil from steam we do not know, and would suggest that you consult a patent attorney as to the risks you might run. There are several recent patents on grease-separators.]



THE INDIRECT INCOME OF WATER-SUPPLIES.*

ALL time saved from hard labor is a gain. The convenience in cities and towns is a great advantage. In estimating the returns to be secured from a water-supply for a place consideration must be had for items not appearing on the company's books, but which have a value inestimable in dollars. These are:

on the company's books, but which have a value inestimable in dollars. These are:

First—Promotion of health. Water from a supply system averages much purer than from wells. It is stated that typhold fever has practically become a country disease. In certain New England counties the lowest average mortality is in districts where there are many cities and towns, most of which have water-supplies and sewerage systems. The highest mortality is in sparsely-settled towns having no public works of this nature. Without a water-supply we can scarcely have any sewerage system. The sprinkling of streets and decrease of repairs on gravel and macadamized reads are worthy items.

Second—By saving property. A supply of water for fire purposes can best be provided in connection with the domestic supply, and the power to prevent a widespread conflagration lies usually in the proper arrangement of the water-supply system where the hydrants should not be located too near large wooden buildings.

Third—By reducing insurance. The insurance companies of New England are always ready to recognize the introduction of water by a very substantial reduction of their relative generally from twenty to fefty near contributions.

introduction of water by a very substantial reduction of their rates, generally from twenty to fifty per cent.

Fourth—By encouraging manufactuers. Many mills have private fire appliances, but all need external protection, and a reliable water-supply and a consideration of its provisions and the consequent insurance rates often determines the location of great manufactories.

President Fanning stated that he had found that for five years after the water-supply was introduced in a certain city the saving in insurance over the rates that prevailed before had been greater than the cost of the supply during

PUMPING ENGINES.+

MR. GERECKE made some remarks about the Chicago pumping engines, where great trouble had been experienced from air in the cylinders, which were introduced to secure back-pressure on the valves. This should never be resorted to. The valves should be made smaller and heavier and no trouble would arise.

In Chicago a vertical engine pumps water for flushing

For six months in 1886 the cost of coal as a fuel for this engine was carefully computed and then for six months in 1887 that of oil. It was found that there was a difference of twenty-two cents per hour, or of \$885, for the six months in favor of coal, but the bill was reduced so as to make the cost about the same for the city. The evaporation by oil was greater than that by coal, and if account had been taken of the labor saved the oil would probably have appeared most economical; as it was, a certain number of men were kept continually, and the use of oil simply gave them so much more idle time.

Q. What difference was perceptible in the wear and tear with the different fuels?

A. None; but I believe oil to be less injurious. It gave more uniform pressure and there were no accidents of any kind connected with its use.

Q. Were there any offensive fumes?

A. Never from the chimneys or outside of the house; of course the oil itself has some odor.

of course the oil itself has some odor.

Mr. Priddy—We are using a good deal of oil for fuel among the hills. It is used from tanks and the only accident that has occurred was directly due to the carelessness of the engineer.

HYDRANT JACKETS.+

A SHORT volunteer paper was presented describing some experiments made by the author to determine the value of cloth jackets for fire-hydrants. During last January, when the weather was exceptionally cold, two self-registering thermometers were placed inside the barrel of a hydrant at a distance of I foot, and 4 feet 6 inches below the surface of the ground. These recorded minimum temperatures of 31° and 26° respectively, and conbelow the surface of the ground. These recorded minimum temperatures of 31° and 36° respectively, and confirmed the theory that warm air and gas is being constantly disengaged and forms an upward current that is diffused through the hydrant and adjacent ground, and will always prevent freezing, thus making any jacket protection superfluous tection superfluous.

WESTERN GAS ASSOCIATION.

THE 11th annual meeting of this association will be held at Chicago May 9, 10, and 11.

The following papers will be presented:

"Fuel Gas," by Walton Clark; "Half-Depth Regenerative Furnaces," by Frank Bierce; "Inclined Retorts." by Henry Pratt; "Gas Company Accounts," by J. D. Thompson; "The Cost of Electric (Arc) Lighting," by

*Abstract of paper read at Cleveland, April 18, before the eighth annual meeting of the American Water-Works Association, by Member F. L. Fuller.

†Discussion at Cleveland, April 19, before the 8th annual meeting of the American Water-Works Association.

‡ Paper read April 18, at Cleveland, before the eighth annual meeting of the American Water Works Association, by Associate Member A. Beaumont.

C. M. Keller; "The Maximum Service that Should be Required for the Various Standard Sizes of Meters," by William McDonald; "Purification in Closed Vessels," by Frederic Egner; "Incandescent Gas-Burners," by Edward Lindsley; "A Paradoxical Box," by B. E. Chollar; "Observations: Gaseous and Otherwise," by George Shepard Page.

Professor T. C. Mendenhall, President of the Rose Polytechnic Institute, Terre Haute, Ind., will lecture on "Photometric Standards and Processes," and Mr. Frederic Egner will tell of "The American Gas Institute."

The Committee of Arragements are Messrs. Henry Pratt, George C. Hicks, E. H. B. Twining, Frederick R. Persons, and John Stout. Mr. A. W. Littleton, of Quincy, Ill., is the secretary of the association.

Members of kindred societies are invited to be present and take part.

THE AMERICAN SOCIETY OF CIVIL ENGI-NEERS.

A REGULAR meeting was held May 2, Vice-President J. J. R. Croes presiding. After the usual order of business the secretary stated that the last week in June had been selected for the date of the annual convention and that the excursion would be via the Michigan Central Railroad, from Buffalo to Milwaukee.

Members intending to present papers at this meeting are urgently requested by the committee to prepare them early enough to enable advance copies to be printed and distributed among the members for preparation of discussions.

The bequest was announced from the late member, Mr. Sullivan Haslett, of all his engineering books to the society's library.

The secretary read a rejoinder from John W. Hill, Mem. Am. Soc. C. E., to Mr. Howell's discussion of the former's recent paper on "The Test of an Edison Incandescent Electric-Lighting Plant," and extracts from a communication by Joseph Nimmo, Jr., on "Fertilizing Material of New York and Brooklyn in its Relation to Transportation."

The report of the tellers appointed for the membership ballot was then received and the meeting adjourned.

The following candidates were elected:

As Members .- Kenneth Allen, in charge of preliminary location Kansas City, Lawrence and Nebraska Railway, also Consulting Engineer Greenleaf, Kan., Water-Works, Kansas City, Mo.; Latham Anderson, Civil and Sanitary Engineer, Cincinnati, O.; Thomas Aspinwall, in charge surveys and construction West End Land Co.'s Improvements at Boston, Mass.; Robert Bassel, Technical Attache Imperial German Legation, Washington, D. C.; Harry Dean Bush, Superintendent Lachine Works Dominion Bridge Co., Montreal, Can.; Clarence Allen Carpenter, Division Engineer Kansas City from Marion, Iowa, to Kansas City, Mo., C. M. & St. P. Ry. Chillicothe, Mo.; George Edwin Evans, Engineer Water-Works, Helena, Mont.; Francis Davis Fisher, Resident Engineer Suburban Rapid Transit Co., New York City.; Arthur Hodges, Chief Engineer Johnson Steel Street Rail Co., Johnstown, Pa.; George Washington Howell, engaged in miscellaneous engineering, and Bridge Engineering for Morris County, Morristown, N. J.; Everett Wilson Lew's, Assistant Engineer in charge of Spokane and Palouse Railway, Belmont, Wash. T.; Emile Low, Division Engineer Clinch Valley Division Norfolk and Western Railroad, Cedar Bluff, Va.; Harry Irving Miller, Engineer Maintenance of Way, Chicago, St. Louis and Pittsburg Railroad, Richmond, Ind.; Arthur Lorenzo Mills, Chief Engineer Toledo, St. Louis and Kansas City Railroad, Mills, Chief Engineer 101edo, St. Louis and Kansas City Kauroad, Toledo, O.; Edmund Trowbridge Dana Myers, General Superin endent Richmond, Fredericksburg and Potomac Railroad, Richmond, Va.; Philip M. Price, Instructor of Practical Military Engineers mond, Va.; Philip M. Price, Instructor of Practical Military Engineering at Military Academy in Command Co. E Battalion of Engineers, and in charge of the Water-Supply of West Point, N. Y.; Beverley Strother Randolph, Mining Superintendent Consolidation Coal Company of Maryland, Frostburg, Md.; Thomas Pearman Shanks, Chief Engineer Little Falls Water Power Co. of Minnesota, Snanks, Chief Engineer Little Falls Water Power Co. of Minnesota, residence, Louisville, Ky.; George Morris Tompson, Chief Engineer Boston and Lowell Railroad, also in charge of construction of Central Mass. Railroad, Boston, Mass.; Thomas Delano Whistler, recently Division Engineer New York Steam Co., New York City.

As Associate. - James Breckenridge Speed, General Manager Louisville Cement Co., Louisville, Ky. As Juniors .- James Hillhouse Fuertes, with Chief Engineer As Juniors.— James Hillhouse Fuertes, with Chief Engineer Wichita Land Company, Wichita, Kan.; William Gray, engaged on New Crotca Aqueduct, Tarrytown, N. Y.; Horace Joseph Howet Assistant to Roadmaster, Susquehanna Division New York, Lake Eric and Western Railroad, Elmira, N.Y.; Edmund Trowbridge Dana Myers, Jr., Assistant City Engineer, Richmond, Va.; John Edwin Ostrander, engaged on enlargement of Locks, Eric Canal, Macedon, N. Y.; Charles Bradley Rowland, engaged with Continental Iron-Works, Greenpoint, N. Y.; Eugene Raymond Smith, engaged in Works, Greenpoint, N. Y.; Eugene Kaymond Smith, engaged in general engineering and surveying, Islip, N. Y.; William Helland Stair, Superintendent of Construction at Fort Riley, Kan.; George Atwater Tibbals, engaged in Machine Shops of Continental Iron-Works, Brooklyn, N. Y.; Samuel Gaylord Tibbals, engaged in Machine Shop Continental Iron-Works. Brooklyn, N. Y.; Herbert Waldo York, engaged in general civil and mechanical engineering, New York City New York City.

AMERICAN GAS-LIGHT ASSOCIATION.

THE sixteenth annual meeting of this association will be held in Toronto, October 17, 18 and 19, when a prize of £5 will be awarded for the best paper on "Naphthaline." The Research Committee is now fully organized and ready for business: Chairman, Colonel Frederick S. Benson, Engineer of the Nassau Gas Company, Brooklyn, N. Y.; Secretary, Charles F. Prichard, Superintendent of the Lynn (Mass.) Gas Company; other members, A. E. Boardman, Macon, Ga.; T. Littlehales, Hamilton, Canada; J. B. Crockett, San Francisco, Cal.; James Somerville, Indianapolis, Ind., and William J. Fay, Denver, Col. If any member of the association has a problem which he wishes the committee to assist him in solving, he has THE sixteenth annual meeting of this association will

he wishes the committee to assist him in solving, he has only to call on the member of the committee in his district, and he can, if necessary, secure the assistance of the entire committee. The chairman of the committee will be glad to give members any desired information in regard to its methods. Mr. C. J. R. Humphreys, of Lawrence, Mass., is the Secretary of the Association.

ENGINEERS' CLUB OF PHILADELPHIA.

A REGULAR meeting was held April 21, 1888, President Joseph M. Wilson in the chair, Howard Murphy, Secre-: 30 members and I visitor present.

The secretary announced the gift, by Mr. John S. Naylor, of Van Nostrand's Engineering Magazine, 1869 to 1886, bound in half morocco, for which a vote of thanks

was returned.

Mr. L. F Rondinella presented a series of "Steam Formulæ" for the Reference Book; Mr. William Sellers a paper upon the "Manufacture of Eye Bars for Pin-Connected Structures," illustrated by full-size test specimen, etc. Mr. John L. Gill, Jr., discussed the desirability of expanding in, and of beading over, boiler-tubes, and raised the point as to whether beading over was not, in some cases, unnecessary or even injurious.

The president as to whether beading over was not, in some cases, unnecessary or even injurious.

The president announced the following as the committee to recommend a practical method of testing cements. Messrs. Arthur Marichal, Herbert Bamber, Professor L. M. Haupt, Rudolph Hering, and John C. Trautwine, Jr.

THE UNCERTAINTIES OF UNDERGROUND WORK.

ONE of the curious facts in connection with the construction of the flushing tunnel at Milwaukee is the struction of the flushing tunnel at Milwaukee is the ease of excavation at the river and lake ends, where it was generally expected that, despite the protection of cofferdams, great trouble would be experienced from percolating water, while in the middle section—about equi-distant from lake and river—water and quicksand have made the progress of the work very slow. Recently a spring was struck that welled up so copiously from a hole made by a workman's pick that the discoverer could hardly get away from it in time to avoid injury. Since then the pump has been kept at work night and day to keep the big bore from being flooded.

from being flooded.

The experience of the tunnel contractors is an illustration of the risks which bidders for underground public work run in making contracts. There is no telling what one will meet in burrowing in the bowels of the earth. Test bores may be never so favorable, yet the ground may prove to be a bed of quicksand with intervals of solid earth into which the bore of the testers has, unfortunately for the contractor, struck in every instance.

The man who digs tunnels by contract is virtually investing in the lottery of fate—he may make and he may break.

SHOCK IN PIPES.

SHOCK IN PIPES.

The sudden stoppage of flow in pipes produces forces, due to the sudden change of momentum, which are often considerable. Lead pipes, for instance, are often gradually expanded and then burst by the shock produced by taps which suddenly close. Mr. Binnie experimented on a case of this kind. A lead pipe, ¾ of an inch in diamter and 114 feet long, was connected with a 3-inch main and fitted at the other end with a plug-cock having a waterway of 0.152 of a square inch only. At a pressure-gauge near the cock the pressure was 125 pounds per square inch before the cock was opened, 20 pounds when the cock was opened, and 550 pounds when the cock was suddenly closed, the pressure falling back after a series of oscillations to 125 pounds. Even at the inlet of the lead suddenly closed, the pressure falling back after a series of oscillations to 125 pounds. Even at the inlet of the lead pipe from the main the effect of the shock was felt, the pressure rising to 220 pounds when the plug-cock was closed. It is to avoid danger from shock that screw-down valves, which close slowly, are in some towns insisted on —From lecture on "Hydraulics for Architects," by Prof. Merwin in London "Builder."

THE builders of Syracuse, N. Y., have organized "The Master Builders' Association." Thomas Talbot, Jr., James E. Baker, William Crabtree, and others, trustees

PERSONAL.

MR. J. H. PECK has been elected President of the Rensselaer Polytechnic Institute, Troy, N. Y.

MESSRS. BURNHAM & ROOT, of Chicago, have removed to their permanent offices in "The Rookery," the new office building, of which they were the architects.

SECOND LIEUTENANT JOSEPH E. KUHN, Corps of Engineers, U. S. A., has been relieved from duty at Willetts Point, N. Y., and ordered to duty at Grand Rapids,



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

THE Composite Iron-Works Co., 83 Reade Street, New York, has issued a pamphlet illustrating and describing the Bostwick patent folding-gate for a variety of purposes, which will be sent free on application. will be sent free on application.

WE have received from the Portland Stone Ware Co., Portland, Me., and 42 Oliver Street, Boston, Mass., their illustrated catalogue and price-list of fire-brick, tiles, sewer-pipe, terracotta vases, etc., manufactured by them.

ARCHITECTURAL COMPETITIONS.

LAS ANIMAS, Col.—Hospital.—Plans are wanted, until May 12, for a County Hospital Building, to consist of basement, first and second stories. For circular of instructions, etc., address G. M. Hill, County Clerk, Bent County, as above.

DELPHOS, O.—Town Hall.—Plans are wanted here, until May 12, for a town hall, to cost \$15,000. For details address J. M. Kollsmith, as above.

SEYMOUR, IND.—Church.—Plans are wanted here for a church edifice, to cost \$100,000. No date specified. For details address the Rev. P. Schmidt, of the German Lutheran Congregation.

COLUMBUS, O.—Ground Improvement.—Plans are wanted here, until May 15, for complete plans for the improvement of the grounds known as Franklin Park, plans to show roads, drives, walks, and the exact location of all other artificial structures necessary. A premium of \$300 is offered for the best and accepted plans. For circular of instructions address George Donaldson, Secretary of the above institution, as above.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-yiii-332-ix.

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, waill be liberally paid for.

WATER, SEWERAGE, ETC.

SALT LAKE CITY, UTAH.—Water and Sewers,—The officials of this city are considering plans for improving the water-works plant and extending, etc., the sewerage system. It is probable that conclusive steps will soon be taken and that plans will be adopted. Details can be obtained from Mayor Armstrong.

FULTON, N. Y.—Sewers.—Several blocks of additional sewers are to be laid here.

KNOXVILLE, TENN.—Sewers.—The election to decide for or against sewerage for this city, held here April 28, decided against the proposition. It is claimed that the taxpayers favor establishing a sewerage system, but were opposed to the particular method proposed. Another election will probably be held.

Geneva, N. Y.—Water.—Our correspondent writes: "The Geneva Water-Works Company has closed a contract with the village for 75 hydrants, or more, as may be ordered by the trustees. They will put down about four miles of o and 8 inch pipe, which will make its system 12 miles long. Contracts for the proposed work will be made as soon as plans and specifications can be perfected."

LIGONIER, IND.—Water.—P. V. Hoffman, Town Attorney at this place, writes as follows: "Our town will elect water-works trustees May 7. Any time after that they will be ready to examine any system or plans proposed. They have not yet adopted any plans or any known kind of system."

ORLEANS, NEB.—Water.—J. O. Stromburg, City Clerk here, writes us under date of April 24, as follows: "At the election held here yesterday the water bonds carried by a large majority. The work is to commence within five days after the first delivery of the pipes, and the entire works specified to be completed on or before thirty days from such date. A. A. Richardson is the engineer, from Lincoln, Neb."

PAVONIA, N. J.—The time for opening bids for erecting a stand-pipe has been extended to May 9. For details address Robert L. Barker, Chairman Water Committee, Camden, N. J.

BURLINGTON, VT.—Water.—A new reservoir will probably be built here at a cost of about \$25,000. Other im provements will also be made to the water-works \$95\$=tem.

WALDOBOROUGH, MB.—Water.—Regarding water-works matters here, our correspondent writes as followers: "There has been a charter obtained from the legislature, but as yet no company organized under it. The ctown at its last annual meeting voted to approprie atte \$600 per year for the term of ten years. I under the term of ten years. I under a tand it their report is favorable a company will be accided at once."

Hamilton, Ont.—Water.—It is proposed to expend about \$10,000 in laying additional water-mains in this place, and proposals will soon be wanted for the work. The Water-Works Committee can furnish details.

BURRILLYILLE, R. I.—Water,—The taxpayers of this place will hold an election May 5 to settle the question of appropriating \$4,000 per year for a water-supply. An offer has been made to provide the place with an abundant supply of water, to furnish 12s hydrants, two hose carriages with hose, public drinking and display fountains, free water for street sprinking, churches, schools, and other advantages. The system can be purchased by the town at any time. It is thought that the measure will carry.

ONEIDA, N. Y.—Sewers.—At a special election neld here April 27 to decide whether the village would issue bonds in the sum of \$80,000 to construct a system of sewerage, the project was defeated by a large majority. It is said that the taxpayers favor establishing a sewerage system, but as many individual preferences existed concerning the amount to be expended, etc., the measure was lost. It is thought, however, that the matter will be compromised and the project carried at another election to be held at an early day. The Village Clerk can furnish details.

PHILADELPHIA, PA.—Water.—The Water Committee of the City Councils have been requested to grant authority to the Disston and Holmsburg Water Companies, both places suburbs of this city, to lay pipes under the streets and supply the inhabitants with water until such time as the mains of the city works are extended to these localities. At a meeting of the above committee, held May 1, the matter was referred to the Committee on Works, with instructions to report regarding the feasibility of the undertaking at the next regular meeting.

WINCHESTER, Kv.—Water.—Reports say that the people of this place have decided in favor of water-works.

PULASKI, TENN.—Water.—It is reported that a system of water-works is to be established here and that the Mayor can furnish details.

Dybrsburg, Tenn.—The water-works question is being agitated here.

PARIS, Kv.—Sewers.—The sewerage question which has been discussed for a long time by the taxpayers of this place is to be settled at a public election to be held shortly, and it is thought probable that a system will be established.

AUBURN, ME.—Water.—Regarding the report that a water-works system was to be established here City Clerk J. W. Mitchell writes as follows: "We have a system of water-works in this city which has been in operation for several years, and I am not aware of any steps being taken to organize any other."

GRAND JUNCTION, Col.—Water.—The water-works project at this place is to be settled at a public election to be held this spring. It is thought that a favorable result will be had.

NRVADA, Mo.—Water.—The Nevada Water-Works Company will expend \$50,000 on improvements.

VALENTINE, NEB.—Water.—It is reported that this place is considering a water-works project

CATOONA SPRINGS, GA.—Water.—It is reported that a system of water-works is to be established here.

MALONE, N. Y.—Water.—Regarding the report that a system of water-works to cost \$00,000 was to be erected here, George Sabin, Superintendent of the Water-Works Company, writes us, under date of May 2, as follows: "Held our annual meeting this day. Had election of officers, Shall be ready to receive proposals soon, and shall push things with all possible speed."

CLAYTON, PA.—Water.—It is reported that the citizens of this place have decided in favor of water-works

ASOTIN, W. T.—Water.—The Asotin Water-Works Company has been incorporated here. For details address E. Baumeister, as above.

PHILADELPHIA, PA.—Water.—The Duquesne Water Company has been incorporated here with a capital of \$10,000. Details can be had by addressing William Lawler, as above.

EURBKA, KAN.—Water.—This city advertises for bids for doing the work necessary, etc., in the completion of a system of water-works. J. W. Nier, C. E., of Kansas City, Mo., prepared the plans and specifications. For further details see our Proposal Column.

Flushing, N. Y.—Sewers.—The officials of "this place have decided to extend the sewerage system into several new streets, and bids for the work will soon be wanted. For details address W. H. D. Nimmo, Village Clerk, as above.

"New Brunswick, N. J. — Water. — The Board of Water Commissioners has decided to extend the watermains through several additional streets of this place during the summer. The Clerk of the Board can furnish details.

BRUNSWICK, GA.—Sewers.—Mayor D. T. Dunn writes us as follows: "A survey of the entire city is now being made with a view to sewering this fall and winter."

Marion, Ala.—Water.—It is reported that the re-cent water-works agitation here will result in the con-struction of the system at an early day. Details can be had of the Town Clerk.

Newhall, Cal.,—Water.—The Newhall Tunnel and Water Company has been incorporated here, with a capital of \$500,000. John Robinson and others are the directors.

LEXINGTON, VA.—Water.—The water company at this place has decided to enlarge its system. Informa-tion can be obtained by addressing the Mayor, as above.

WATER-WORKS.—See our Proposal Column for information regarding water-works and water-works supplies at the following places: Atlanta, Ga., Aberdeen, Dak., Willimantic, Counc., Plattsmouth, Neb., Colman P. O., East Toronto, E ireka, Kan.

BRIDGES.

SAN MIGUEL, CAL.—Our correspondent writes as follows regarding the bridge project here: "An election has been carried to raise a tax of \$10,000 for the purpose of building a bridge across the Salinos River at this place. The tax will not be collected and will not be available until January, 1889."

BINCROFT, MASS.—Regarding the report that a bridge was to be erected here our correspondent writes: "The towns of Middlefield and Beckett have contracted with the Berlin Iroa Bridge Co., East Berlin, Conn., to build their bridge."

SEATTLE, W. T.—The Elliott Bay Bridge and Pile Company has been incorporated with a capital of \$60,-000. Thomas A. Jones and others are at its head.

RANDOLPH, KAN.—It is reported that the County Commissioners will construct a pontoon bridge across the Missouri River at this place, to cost \$0,000. For details address T. B. Bullene, No. 700 Main Street, Kansas City, Mo.

SAN ANGELO, TEX.—It is reported that the County Commissioners will place an iron bridge over the Concho River at this place. Address them as above.

MONTERBY, CAL.—It is reported that the County commissioners will erect several bridges in Monterey

CUTTINGSVILLE, VT .- An iron bridge is to be erected

POCOPSON, PA .- The County Commissioners are, it is reported, to build a bridge here.

I) WATRACE, TENN.—A bridge is to be built over Watrace Creek, at this place, by the Nashville & Knoxville Railroad Co. The company's office is at Nashville, where details can be obtained.

BRIDGES.—See our Proposal Column for information regarding bridge construction at the following places: Gadsden, Ala., Franklin, Pa., Yankton, Dak., Fort Gaines, Ga.

GAS AND ELECTRIC-LIGHTING.

SIOUX CITY, IOWA.—The Sioux City Electric Light Company proposes to erect a new power house, 50x100 feet, two stories high, with engine power to amount to 200 horse-power; and to add a Westinghouse incandescent electric light plant with a capacity for 650 lights.

EL PASO, TEX.—The El Paso Gas, Coke and Coal o. will erect an electric light plant here.

BARTOW, FLA.—The Brush Electric Light and Power ompany will erect an electric light plant here.

PITTSTON, PA,-The Citizens' Electric Illuminating Co. will erect a \$40,000 plant here. Details will be furnished by K. J. Ross of the above company.

FORT WORTH, TEX.—The Fort Worth Gas and Electric Light Company will expend about \$300,000 enlarging its plant. Besides adding to the gas-works, an electric light plant, for arc and incandescent lighting, will be built.

LAURENCE, KAN.—An electric light company has been organized here with J. D. Bowersock at its head, A \$30,000 plant is to be established, to include two engines of 200 horse-power each, and a dynamo, capacity of 70 arc and 1,000 alternating incandescent lights. The Thomson-Houston system will be used.

CONGAREE, S. C.—The Congaree Gas and Electric Company will establish an electric-light plant here. J. T. Sloan can furnish particulars.

GLOUCESTER, MASS.—The Gloucester Electric Light Company, capital \$20,000, will establish a plant here. For details address William A. Jordan.

CHRISTIANSBURG, VA.—An incandescent electric-light plant is to be established here. For details ad-dress C. P. Poole, Lynchburg, W. Va.

MIDDLEBORO, MASS.—An electric-light plant is to be erected here. Address George A. Cox.

ELYRIA, O.—An electric-light plant is to be estab-lished here. F. A. Beckwith can give information.

CATLETTSBURG, Ky.—An electric-light plant is to be established here.

RAILROADS.

BROCKTON, MASS.—A street railroad is to be built ere. For details address E. L. Brown, engineer, as here. above.

ALTON, ILL.-A street railway is to be built here.

MURPRESSOROUGH, TENN.—The officials of this place have granted a charter for a street railway, which is to be built as soon as the details can be effected.

BIRMINGHAM, ALA.—The Georgia Pacific Railway will lay 134 miles of track. Complete details can be found in our Proposal Columns.

LAWRENCE, KAN.—A project is on foot to build a street railroad from this place to West Lawrence. Kansas City capitalists are at the head of the scheme, and a charter will probably be granted at the next meeting of the City Council.

SMITHWOOD, TRNN.—Surveys are being made by the Knoxyille and Fountain Head Railroad Co. for an electrical railroad, to be about four miles in length. The president of the above can furnish details.

HUNTINGTON, W. VA.—An electrical street railroad about four miles in length is to be built here, to be in operation by July z. Centre-bearing rail is to be used. J. L. Young can furnish complete information.

ENTERPRISE, FLA.—A project is on hand to build a street railroad here.

BIDS OPENED.

RALEIGH, N. C.—Sewers.—J. L. Ludlow, C. E., sends us the following communication: "All bids for the Raleigh sewerage system construction received April 16 were unsatisfactory and all rejected. Construction is postponed, but propositions to construct the work will be received and considered at any time by the committee."

TILBURY CENTRE, ONT.—Water-Works.—The following bids for constructing a system of water-works for this place were opened April 25, by A. A. Wilson, Village Cierk · Fluke & Bohack, Windsor and Chathams, Ontario, \$12,356. John Carril & Co., London, Ontario, \$10,200; Miles, Hunting & Co., Hamilton, Ontario, \$44,846. Six other tenders were received for parts of the work. The contract was awarded to John Carril & Co.

PITTSBURG, PA.—Bridges.—The following bids for the erection of eleven new county bridges were opened April 27 by the County Commissioners:

The lowest bids for bridge masonry were as follows:
Long Run Bridge, Charles J. Lindquist, \$6.15 per cubic yard; Pine Creek Bridge, Eli Crum, \$5,74; Robinson's Run Bridge, M. Sweeney, \$6.60; Bull Creek Bridge, M. Sweeney, \$6.50; Bull Creek Bridge, M. Sweeney, \$6.75; Peter's Creek Bridge, Jacob Friday, \$7.50 per cubic yard for masonry, and 25 cents per lineal foot for piles and capping; Little Pine Creek Bridge, C. M. Driver, \$7.48; Shoop's Run Bridge, M. Sweeney, \$6.90; Burls Run Bridge, M. Sweeney, \$5.00; Sawmill Run Bridge, M. Sweeney, \$6.90; bridge across the back channel of the Ohio River to Neville Island, Jacob Friday, \$8.50 per cubic yard for masonry, \$4.75 per cubic yard for concrete, 25 cents per lineal foot for piles and capping and \$17 per 1,000 feet for timber.

The bids for the iron superstructures for the ten first named bridges are as follows: Pittsburg Bridge Company, \$11,400; J. M. Walker, \$11,600, and Keystone Bridge Company, \$12,508.

The Pittsburg Bridge Company received the total award.

Ottawa, Kan.—Sewers.—I. B. Jenkins & Co., o

OTTAWA, KAN.—Sewers.—J. B. Jenkins & Co., o Fort Scott, have received the contract to build the main sewers of a sewerage system for this city. The mains will cost \$50,000 and the laterals \$60,000.

MILWAUKER, WIS.—Sewers.—The contract for building a sewer in North Avenue has been let to Oscar Knie, at \$23,888.07.

BOSTON, MASS.—Sea Wall.—Proposals were received May 1, by the Charles River Embankment Co., for building 800 feet of sea wall on Charles River, but owing to the absence of the President they were not opened.

opened.

ALLEGHENY, PA.—Pumping Engines.—The following bids for furnishing two separate engines, of 36 and 48 inch stroke respectively, were opened April 2 by the Water Committee: Wilson, Snyder & Co., \$42,000 and \$45,000; the George F. Blake Manufacturing Company, \$43,450 and \$54,600; Henry R. Worthington, York, \$58,600 and \$42,000 nt wo patterns of 36 inch stroke and \$46,000 for the 48 inch. The same firm put in a bid for sets of steam pipe, valves, etc., for \$2,875. The Gordon, Maxwell Company, one bid on 36 inch, \$40,000. The Holly Manufacturing Company, Lockport, N. Y., three bids, all on 36 inch, for \$70,000, 348,000, and \$56,000, the specifications describing the classes to account for the discrepancies. The bids were referred to the Machinery Committee.

classes to account for the discrepancies. The bids were reterred to the Machinery Committee.

Toronto, Canada.—Water-Works Supplies.—The following awards have been recommended by the Committee on Water-Works, furnishing supplies required by the Water Department during the year:

St. Laurence Foundry Company, Toronto, pipe, 3 inch, per ton, \$44.80; 6 inch, \$38; 12 inch, \$37.50; Treloar, Blashford & Co., Toronto, special castings, per 100 pounds, \$2.25. Charles Smith & Co., Toronto, hydrants, 126, 50; 12 inch valves, each, \$0; 6 inch valves, \$16.50; 12 inch valves, \$39.50. St. Laurence Foundry Company, Toronto, according to de sign, as follows: \$64. \$45, \$57. \$51. \$70. \$83; iron stop-cock boxes, single, \$1; double, \$1.50. F. Stevenson, Toronto and Montreal, lead pipe, \$4, \$6. \$4, \$6, \$7. \$1 inch, per 100 pounds, \$3.80; James Robertson & Co., Toronto, wooden stop cock boxes and nipple blocks, double boxes, each, 20 cents, single, 25 cents, nipple blocks, each, 12 cents; Thomas W. Self, brick meter chambers, per 1, coo bricks, \$15.90; Burns & McCormack, Toronto, pipe laying according to specifications, \$3,850; F. W. Unitt, Toronto, general stores, according to specifications, \$3,865; St. Laurence Foundry Co., purchase of scrap iron at engine house, cast iron, per ton, \$14.50, wrought, \$11.95.

GOVERNMENT WORK.

GOVERNMENT WORK.

MOBILE, ALA.—Channel.—The following bids for constructing Lock No. 1 and the excavation of a channel below in the Warrior River were opened April 23 by A. N. Damrell, Major of Engineers, U. S. A.: L. M. Pettidider, Cincinnati, O., \$161,448.75; J. A. J. Smith, Cincinnati, O., \$172,061.87; Reilly & Gude, Atlanta, Ga., \$162,557.85. The following bid, with no signature or bidder's bond, was received from Birmingham, Ala.: \$97,610.80.

DETROIT, MICH.—Dredging.—General Poe, of the United States Engineer's Office, has recently let the contract for dredging the harbor at Cheboygan to Chauncey E. Mitchell, at 144 cents per cubic yard. He has also let the contract for drilling and blasting



in the Soo Canal to Hickler & Green. The specifica-tions call for the removal of all the rock for a distance of 700 feet above the movable dam, to a uniform depth of at least 21 feet. It will require the drilling of 2,000 holes 6½ feet deep and about 2 inches in diameter. The contractors furnish everything and get \$4.47 per hole for the drilling and blasting.

PHILADELPHIA, PA.—Delaware River Improvement.
—The following bids for furnishing and depositing stone in constructing a dike in the Delaware River, near Mifflin Bar, opened April 27, by Lieut.—Col. Henry M. Robert, Corps of Engineers: John Satterlee, Englewood, N. J. per cubic yard, \$1.93; Brandywine Granite Co., Wilmington, Del., \$1.75; George R. Stephenson, Lapidum, Md., \$2.10; James E. Spencer and W. W. Virdin, Lapidum, Md., \$2.05; James H. Ward, Ridley Park, Pa., \$1.19; John A. Bowker, New York City, \$1.65.

The bids of George R. Stephenson, James H. Ward and John A. Bowker were informal.

The following bids for constructing a dike in the Delaware River from the lower end of Reedy Island were opened on the above date by Lieutenant.—Col. Henry M. Robeit, Corps of Engineers: Approximate quantities, 4,000 cubic yards of brush mattress; 20,000 cubic yards stone. Bidders—John Satterlee, Engelwood, N. J., \$43.160; John A. Howker, New York City, \$4*,800; John C. Churchill, Jr., Burlington, Vt., \$42.360; Ira Lunt, New Castle, Del., \$37,760; Brandywine Granite Co., Wilmington, Del., \$35,200. The bid of the last-named firm was recommended for ac ceptance. The bid of John A. Bowker was informal.

TERRE HAUTE, Ind.—Post-Office.—The following TERRE HAUTE, Ind.—Post-Office.—The following bids for the interior finish, including iron statist, lichtwell finish, lathing and plastering, marble work finished floors, joining, glass, hardware, painting, and polishing for post-office were opened May 1 by the Supervising Architect of the Treasury Department: Colins & Ohm, \$22,000, \$31,600 omitting attic floor; Robinson Planing Mill Co., \$31,451; John Mitchell, \$32,928.60; John O'Connor, \$27,000; Robert Mitchell Fur. Co., \$36.276.74; Shover & Christian, \$31,372; McCarthy & Baldwin, \$31,074; George W. Corbett, \$31,500.

WASHINGTON, D. C.—Torpedo Boat.—The opening bids for the construction of a submarine torpedo boat which was to have taken place May r, was post-poned until May 3.

WASHINGTON, D. C.—Removal of Wrecks.—The following bids for the removal of three wrecks in Mattaponi River, Va., between Ayleits and Walkerton, were opened April 28, by Col. Abert: John L. Johnson, Fulton, N. V., \$7,500; Thomas P. Morgan, Washington, D. C., \$4,500; William H. French, Berkley, Va., \$1,800.

GALVESTON, TEX. -- Court-Honse.—The following proposals for the erection, etc., of the court-house, etc., at this place, were opened May 2, by the Supervising Architect of the Treasury Department:
Colins McK Grant, \$139,000; Charles S. Ott, red stone, \$142,300, red stone and terra cotta, \$170,603; Samuel W. Swift, \$139,000; Charles Lundberg & Co., portico entry with Linden stone trimmings \$118,506, with Bedford limestone throughout, \$108,506; McCarthy & Baldwin, Texas stone and Galveston pressed brick, \$131,930, Texas stone and Galveston pressed brick, \$131,235, portico entry and St. Louis pressed brick, \$141,245, portico entry and St. Louis pressed brick, \$145,007, red.granite and St. Louis pressed brick, \$157,696.

CARSON CITY, NEV.—Court House.—The following bids for the erection of a court house, etc., were opened May 1 by the Supervising Architect of the Treasury Department; Henderson & Haliday, \$102,900; James H. Coster, \$6,5,44; John O'Connor, \$105,000; George D. Nagle, \$80,000.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; afart house, apar' nent-house; ten, tenement; e, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK.

236 Delancey, br flat with stores; cost, \$20,000; o, A Kling; a, G B Pelham.

124 Greene, iron and br st; cost, \$35,000; o, L Sachs & Bro; a, R Berger.

259 Henry, br ten; cost, \$17,000; o, M Solomon; a, Rentz & Lange.

369 Madison, br flat and stores; cost, \$18,000; o, Mrs C Major; a, Rentz & Lange.

385 E 10th, br flat with stores; cost, \$18,000; o, Jonas Weil and Bernard Meyer; a, G B Pelham; b, John Van Dolsen.

542 E 13th, br flat; cost, \$18,000; o, J S Judge; a, D J MacRae.

542 E r3th, br flat; cost, \$14,000; o and a, same as last.

26th, s.s., 185 w. 9th. av., br factory and stable; cost., 15,000; o. Pelham Hod Elevating Co; a, G. B. Pelham. 3 W 36th, br and stone dwell; cost, \$25,000; 0, Estate of S Hall by J T Hall; a, S D Hatch.

240 W 40th, br stone and terra cotta flat; cost, \$16,-

Ws Rider av, 768 s 144th, br factory; cost, \$70,000; o. John T Moore; a, N Le Brun & Son.

215 Henry, br ten; cost, \$23,000; o, Solomon Alter & Jacob kosen; a, Schneider & Herter.

180-200 Washington, br store; cost, \$32,000; 0, estate of R Smith Clark; a, W B Lubby.

45-47 W B'way, br store and lofts; cost, \$30,000; o, E C Koerner; a, W Kuhles.

69 McDougall, br ten; cost, \$18,000; o, Ruchell & Hodges; a, A B Ogden & Son.

648-652 3d av. 2 brick tens; cost, \$42,000 all; a, H A Weeks; a, Berger & Baylies.

55 Walker, br business bldg; cost, \$35,000: o, Manhattan Real Estate Association; a, Rich Berger.

41-45 Jane, 3 br dws; cost, \$51,000 all; 0, Robt Dick; a. A B Ogden & Son.

BUILDING INTELLIGENCE. NEW YORK CITY-Continued

8th av, s e cor 40th, br flat with store; cost, \$28,000; Walker & Lawson; a, M V B Ferdon.

104th, n s, 175 e 10th av, 5 br and stone flats; cost, 25,000 each; a, J Edelmeyer and W Morgan; a, G B

8th av, s w cor 119th, br ten and st; cost, \$12,000; o, S Lynch; a, J A Webster.

8th av, w s, 25 s 119th, br ten and store; cost, \$10,-00; o, S Lynch; a, J A Webster.

oth av, s w cor 97th, br and stone flat and store; cost, \$20,000; o and b, G E Beaudet; a, R R Davis.

= 130th, s s, 165 e 4th av, br apartment house; cost, \$18,000; o, F Rohrs; a, J Barrett

136th, 5 s, 125 e 7th av, 2 br dwells; cost, \$8,000 each; o, S J Wright; a, Cleverdon & Putzel.

661-761 E 139th, inclusive, 50 br and stone dwells; cost, each \$4,500; o, William O'Gorman and Herman Stursberg.

Ws 9th av, 49 8 21st, br ten; cost, \$20,000; o, Alexander Walker and Daniel Lawson; a, M V B Ferdon. 418 420 E 89th, 2 br dwells; cost, \$32,000 all; o, John Livingston; a, F T Camp.

W s Third av, 25 n 154th, 3 br stores and dwells; cost, \$24,000 all; o, Levinia J Palmer; a, M J Sand-

682 Water, br ten; cost, \$21,000 all; o, Herman Hef-ken; a, Wm Graul.

nor Park pl., br store; cost, \$18,000; o, Mrs Mary C King; a, not given.

King; a, not given.

S w cor 84th and Lexington av, br dw; cost, \$40,000; o, Peter Solomon; a, Julius Kastner.

165 E 115th, brick dw; cost, \$18,000: o, Elizabeth G Howe; a, Andrew Spence.

S s ri6th, 100 e 2d av. 4 brick dws; cost. \$60,000 all; o, Eva Mueller; a, Edward Wenz.

ALTERATIONS-NEW YORK.

Washington, s w cor Hubert; cost, \$8,000; o, Holmes & Vanderveer; a, J Munkowitz; b, J C Lyons

42d to 45th st, Vanderbilt av to Depaw pl; cost, \$20,000; o, J M Toacey, Supt N Y C & H RR, Garrison, N Y; a, Walter Katte.

41-43 Wall; cost, \$30,000; o, Orient Mutual Life Ins Co; a, Alfred H Thorp.

225 Madison; cost, \$10,000; o, Annie Stack; a, J A Remer.

139, 141 and 143 W 23d; cost, \$50,000; o, A B Darling: lessees, Proctor & Turner; a, H E Ficken.
30 Washington sq W; cost, \$16,000; o, Elise Kıralfy; a, G B Pelham.

N e cor Fifth av and 23d, br bldg; cost, \$20,000; o, Trustees Masonic Hall and Asylum; a, N Le Brun & 54 Rivington, br dwells; cost, \$10,000; o, Eva Myers; a, G W Spitz.

14 Clinton pl; cost, abt \$8,000; o, F R Walker; a, F A Minuth.

240 West 28th, s s, rear; cost, \$12,000; o, M Groh's Sons; a, Lederle & Co.

25 W 42d; cost, \$0,500; o, Margaret D Griswold; a, J Stroud; b, Smith & Bell.

Wall, s w cor South; cost, \$20,000; lessees, Have-meyer & Elder; a, D & J Jardine.

624-644 W 42d; cost, \$40,000; o, Consolidated Gas Co; a, W H Bradley. a, we in pradley.

41 Fast Broadway; cost, \$7,500; o, Morris Levy; a, Fred Ebeling.

BROOKLYN.

2d st, w s, 170 w 7th av, 7 b s dwells; cost, each

\$0,000; 0, E H Mowbery.

Broadway, e s, 20 n Palmetto, 2 br double stores and flats; cost, total, \$20,000; 0, George B Goodman; b, A Rutan and J A DeCamp.

1,376-1,378 Greene av, s s, 2 br dwells; cost, each

N w cor First and 7th av, br dwell and store; cost, \$10,000; 0 and a, C B Sheldon.

W s 7th av, 50 n First av, 2 br dwells; cost, \$16,000 all; 0 and a, as above.

President, 232 w 8th av, 10 br dwell; cost, \$100,-ll; o and a, W Flanagan.

N s Union, 110 e Third av, 6 br tens; cost, \$30,000 all; o and a, Jos F Brush.

35-37 Bartlett, 2 fr dwells; cost, \$8,000 all; o. J Lins; a, D Acker & Sons.

Ss 18th, 20 w 6th av, 5 fr dwell; cost. \$10,000 all; 0, Geo Keymer; a, not selected.

Se cor Ralph av and Halsey, br dwell and store; cost, \$8.000; o, W Hopkins; a, D Acker & Sons.

S s Hancock, 195 e Patchen av, 7 br dwells and store; cost, \$35,000 all; o, H S Stewart; a, R Dixon. 121 High, br ten; cost, \$11,000; o, Mrs E J Mason; a, J G Glover.

S 5 Macon. 300 e Throop av, 7 br dwells; cost, \$28,-000 all; 0, J J Almirall; a, T G Houghton. S s Livingston, 200 w Nevin, br ten; cost, \$8,500; o, G R Brown; a, not given.

N s Schenck, 310 n Lafayette av, 2 br tens; cost, \$19,000 all; o, T H Brush; a, J G Glover.

#19,000 all; o, T H Brush; a, J G Glover.

Es Buffalo av, 17 n Pacific st, 4 fr dws; cost, \$10,000 all; o, J Frederickson; a, Geo Bush.

W oth av, 60 off Garfield pl, 2 br dws; cost, \$30,000 all; o, E R Kennedy & F F Squire; a, George P Chappell.

Red Hook Lane and Livingston st, Brooklyn Board of Education Headquaters; cost, \$36,000; o, Board of Education; a, Jas W Naughton.

Ne cor Norman av and Diamond st, 2 fr dws; cost, \$10,000 all; 0, Mrs Edward Karney; a, A Herbert.

Ws 7th av, 21 n First st, br dw; cost, \$10,000; 0 and a, C B Sheldon.

Ss Montgomery st, 285 w 9th av, br dw; cort, \$11,-000; o, L S Hannah; a, C P H Gilbert

S & Montgomery st, 265 e oth av, br dw; cost, \$16-005; o, E S Mower; a, same as above 7 Decatur st, br dw; cost, \$7,000; o, J O'Sullivan; a. A W Blazo

485-89 Tompkins av. 3 br dws; cost all \$21,000; o and a, same as above

BUILDING INTELLIGENCE. BROOKLYN-Continued.

N s Eastern Parkway, 70 w Utica av, br dw; cost, 11,000; o, J M Vase; a, Munn & Co.

Es Evergreen av, near Bleecker st, 10 fr tens; cost, \$40,000 all; 0, Michael & Schid; a, H Vollweiler.

McDonough st, 250 e Navy av, 2 brick dws; cost, \$16,000 all; 0, C A Jenneys; a, Geo P Chappell.

S s Clifton pl, 347 e Grand av, 2 br dws; cost, \$9,600 all; o, Jas I Kirby; a, Amzı Hill.

S & Centre st, 80 e Hicks, 12 brick dws. cost, \$96,000 all; o, H Girke; a, A E Hudson.

w cor Henry and Centre sts, 4 br dws; cest, \$32,000 o and a, same as above. S e cor Hicks and Centre sts, 5 br dws; cost, \$40,000 all; 0 and a, same as above.

N s Quincy st, 425 e Norstrand av, 6 fr dws; cost, \$120,000 all; o and a, H Toulmin.

N s President st, 90 w 7th av, 5 br dws; cost, \$27,500 l; o and a, Martin & Lee. S & Troutman st, 100 e Hamburgh av, 6 fr dws: cost, 17,600 all; 0, Dietrich & Reitzenstein; a, H Voll-

516 and 518 Grand st, 2 br dws and stores; cost, \$17,-000 all; o, R C Knipl; a, F J Berlenbacher, Jr.

Se cor Brevoort pl and Bedford av, br residence; cost, \$25,000; o, H L Brevoort; a, C W Romeyn & Co.

s Dean st, 200 w Brooklyn av. 4 br residences; cost, oco all; o, D H Fowler; a, Geo P Chappell. N s State st, 150 w Nevins st, br fire engine house; ost, \$10,500; o, City of Brooklyn; a, Engineers'

N s Herkimer st, 185 e Ralph av, br fire eng house; cost, \$10,500; o and a, same as last.

S s Clymer st, 200 e Bedford av, br fire eng house; cost, \$10,500; o and a, same as last. S s Pulaski st, 95 w Sumner av, 8 br dws; cost, \$38,-oo all; o, Jas W Stewart; a, 1 D Reynolds.

Ns Carroll st, 112 e 8th av. br dw; cost, \$16,000; o, C P Chapin; a, H L Harris.

Es Harrison av, 40 s Hayward st, 3 fr tens: cost, \$15,000 all; o, Beck & Co; a, John Platte.

ALTERATIONS-BROOKLYN.

Es Marcy av, bet Lynch and Hayward sts, brick rmory; cost, \$50,000; o, N Y State; a, E F Gaylor

MISCELLANEOUS.

DETROIT. MICH .--278 Fourth, br dw; cost, \$9,000; o, Richard Helson.

57 Elliott, br dw; cost, \$12,000; o. David Ward; a, Donaldson & Meier. b, l'opping & Fisher.

Jefferson, br dw; cost, \$60,000; o, C C Blodgett; a, E W Arnold; b, owner.

YOUNGSTOWN, O.—The bill allowing \$100.000 for a public building for this town has passed the Senate Nothing over \$7,000 to report.

NEW YORK CITY—The illustrated weekly "Judge" will erect a building on the corner of Fifth Avenue and Sixteenth Street at a reported cost of over \$400,000. McKim, Mead & White, architects, of this city, have already prepared the plans.

WICHITA, KAN.—It is reported that a general depot is to be erected here by the Santa Fe Railroad, depot is to be erecte at a cost of \$60,000.

TOPEKA, KAN. – A \$10,000 residence is to be erected here by G G Gage.

J B Marshall will erect a \$20,000 dwelling on Quincy st.

SPRINGFIELD, MASS.—Liberty st, br addn to factory; o, Springfield Foundry Co

(Continued on page 332.)

PROPOSALS.

(Continued from page viii.)

ROAD, Lexington, Ky.—Proposals are wanted, until May 19, for building 2½ miles of turnpike road. Address J. W. McCann, as above.

CHURCH, Springfield, O.—Proposals are wanted until May 17 for erecting a new church for the trustees of the Congregational Church. Address C. H. Pierce, President, as above.

REBUILDING STEAMER, New York City.—Proposals are wanted until May 11 for rebuilding the hull, 1 iner work, etc., of the steamer 'Minnahanonck.' Address the Department of Public Charities and Corrections, 66 Third Avenue, as above.

OPERA HOUSE, McPherson, Kan—Proposals are wanted until May 15 for completion of the McPherson Opera House above the foundations. Address E. G. Clarke, Chairman Building Committee, as above.

HIGHWAY. East Hartford, Conn.—Proposals are wanted until May 12 for building either the whole or any section of a highway recently laid out in said town, extending from Main Streett ot the Old Mill Road. Address John Kennedy, of the Board of Selectmen, as above.

RAILROAD, Birmingham Ala. — Proposals are wanted until May 12, for the graduation, trestles (framed and on piles), and cross ties necessary for the construction of one single track railroad from Columbus, Miss., to Johnsonville, Miss., a distance of 124 miles. Address Chief Engineer Georgia Pacific Railway, as above, or John W. Johnston, President.

SCHOOL, Milwaukee, Wis.—Proposals are wanted until May 11, for the erection of a primary school building. Address the Board of Public Works, as above.

WATER PIPE, Colman P. O., East Toronto.— Proposals are wanted until May 15 for the supply of cast-iron pipes, 10 and 6 inch, free on board cars at York Station, G. T. R. Address R. Luttrell, Chair-man Water and Light Committee, as above.

RAILROAD TRACK MATERIAL, Washington, D. C.—Proposals are wanted, until May 8, for a quantity of the above, according to specifications. Address James Fulton, Paymaster General, U. S. N., Navy Department, as above.

PROPOSALS.

IRON WORK, Toronto, Can. - Proposals are wanted until May 17 for sundry wrought and cast in work required for the Parliament Buildings. Address C. F. Frazer, Commissioner Department of Public Works for Ontario, as above.

GAS LIGHTING, Boston, Mass.—Proposals are wanted until May to for lighting the streets, etc. of the city proper for a period of five years. Address Hugh T Toland, Superintendent of Lamps, as sixte.

WATER-WORKS, Eureka, Kan.—Proposals are wanied until May 3tfor doing all the work necessar-to the completion of a system of water-works, acord-ing to specifications. Address Mayor H. G. Jooes. 8

SCHOOL, Yankton, Dak.—Proposals are wanted until May 11 for the erection of a brick and size school edifice. Address J. D. Stay, Secretary boars of Education, as above.

CHURCH, Kittanning, Pa.--Proposals are warted ntil May 15 for the erection of a stone church be 2until May 15 for the erection of a stone church be ing for the First Presbyterian Church. Address Geo. T. Crawford, Secretary, as above.

CITY BUILDING, Eric, Pa,—Proposals are wasted until May 20 for the carpenter and wood work, 172, cut stone, cells, vaults, fire-proofing, plastering, thes, marble mantels, steam-heating, plumbing, gas-firing, etc., etc., necessary to finish the basement and firstory of the City Building at this place, including the department of the Mayor, Treasurer, Solicitic, Water Commissioners, Controller, Engineer, Health Office, Supervisors and Police. Bids will be taken for the whole or any part of the work at the Mayor's off-For details address John C. Brady, of the Building Committee, as above.

CUT STONE, New York City.— Proposals in-wanted, until May 10, for furnishing and deliver of cut stone at the reservoir at High Bridge. Adding the Department of Public Works, as above.

GRADING, MASONRY, AND BRIDGING Gadsden, Ala—Proposals are wanted, until May is for the above work on the unfinished portion of 0.2 Road, a distance of 36 miles, between Gadsden and Guntersville; also another contract for 40 miles. Address E. A. Quintard, President Tennessee and Cook Railroad Co., 69 Wall Street, New York City.

VITRIFIED PIPE AND RUBBLE STONE. Atlanta, Ga — Proposals are wanted, until June 6, or furnishing all rubble stone and vitrified pipe require by the Chain Gang Committee in 1888. Address lear T. Cooper, Clerk Commisssioners of Roads and keyenue, Fulton County, as above.

GAS, Philadelphia, Pa.—Proposals are wanted and June 5 for the manufacture and delivery into the hoseers of the above city of illuminating gas. Address the Bureau of Gas, 20 South Seventh Street, as above.

STOP-COCKS, HYDRANTS, ETC., New Yest City.—Proposals are wanted until May 10 for furnishing and delivering stop-cocks, hydrants, wooden hydrant-boxes, and cast-iron stop-cock boxes. Address the Department of Public Works, as above.

STEAM-HEATING, New York City.—Proposis are wanted until May 11 for steam-heating, etc., a priviou (almshouse) on Blackwell's Island, New York Address the Department of Public Charities and Correction, 66 Third Avenue, as above. BUILDING, New York City.—Proposals are wanted until May to for furnishing materials and performs, the work of building a house for storage of coal on the lot between Ninety-sixth and Ninety-sixenth Streets, and a wagon platform. Address the Department of Public Works, as above.

GRADING, Columbus, O.—Proposals are wanted until May 18, for grading the roadway of the Gram is road east of Alum Creek. Address Frank J. Rembard, County Auditor, as above.

SCHOOL, Ludlow Grove, O.—Proposals are wanted until May 15, for doing the brick, carpenter and plattering work, also roofing of the addition to thence school here. Address William Schulhuf, Clerk School Board, as above.

STONE ABUTMENTS, Franklin, Pa.—Proposis are wanted until May 8, for furnishing the material and constructing two stone abutments, according to specifications. Address William A. Maitland, County Commissioner, as above.

COURT HOUSE, Lincoln, Neb.—Proposals are wanted until May 17, for the erection of a court house according to specifications. Address O. C. Bell, County Clerk, as above.

PAVING, Tolede, O.—Proposals are wanted util May 14, for paving certain streets of this city. Address G. H. Cole, City Clerk, as above. BRIDGE, Yankton, Dak.—Proposals are wanted until May 24, for the construction of an iron bridge across Clay Creek at Valus Station, in Yankton County. Address William H. Edmunds, Chairman, Board of County Commissioners, as above.

IRON BRIDGES, Franklin, Pa.—Proposals are wanted here until May 15, for furnishing material and erecting three iron bridges according to specification. Address William A. Maitland, County Commission:

BRIDGE.—INDEPENDENCE, MO.—Proposala are wanted, until May 7, for constructing an incebridge, 165 feet span, over the Bik Blue River at Machester. Address P. H. Ginter, County Surveyor, as

REPAIRING BRIDGE, Fort Gaines, Ga.—Pro-osals are wanted until May 16 for repairing the Chat-ahoochee River bridge. Address Mayor S. D. Co-nan, as above.

SEWERAGE SYSTEM, Aberdeen, Dak.—Proposals are wanted until May 21 for a sewerage system for this place. Address W. F. Lange, Deputy, City Auditor's Office, as above.

SEWERS, Willimantic, Conn.—Proposals are wanted until May 14 for constructing several hundred feet of sewers and doing other detail work here. Address John M. Hall, Chairman Special Sewer Committee, as above.



THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE NEW YORK LEGISLATURE AND THE QUAKER BRIDGE RESERVOIR.

In the last hours of the session of the Legislature an effort is being made to postpone for another year the completion of the work necessary to increase the water-supply of the city. It can have no other object than to extend the official life and consequently the salaries of the politicians whose present means of support is dependent on the continuance of the existence of the complex organization which controls the construction of the work. It is true that this obstruction is adroitly advocated on the ground of public policy and safe provision of possible economy to be secured by more thorough investigation of the problems to be solved. But this is only a trick, and so transparent a one that it is a wonder that the apparent prime mover in the matter does not see that he is being made a tool of by a set of crafty schemers who, to promote their own private ends, are availing themselves of his well-known obstinacy in supporting his fanatical ideas.

The gentleman who is so prominently advocating before the Legislative Committees the bill ordering the postponement of all action in the direction of constructing the Quaker Bridge Reservoir until next year is undoubtedly firmly convinced in his own mind that he has right and reason on his side, but that is no reason why the time of the Legislature should be taken up with listening to him or that his project should be entertained for an instant. The testimony of all the civil engineers of standing and of experience in watersupply on a large scale who have examined and reported on this problem is unanimously and overwhelmingly in favor of the plan which has now been under consideration for several years, and of which the construction of the great reservoir at Quaker Bridge is an essential feature. Indeed, without this reservoir the whole scheme would be an absurdity.

Against this preponderating unity of opinion among the men who have made such subjects the study of their lives is offered the opinion of one man whose success in another line of business requiring shrewdness and pluck, but no previous training or study, has inspired him with the idea that his own "horse sense" is worth more than the accumulated knowledge and experience of generations of engineers, and who has the boldness to openly and persistently advocate his opinions at all times and in all places. From his point of view he may be right, but it is an outrage on the public that he should be permitted to consume the time of public officers in listening to his appeals to delay the execution of the one part of the great water-supply scheme which is essential to its completeness, until, forsooth, the opinions of some more experts can be obtained, in the hope that some hitherto undiscovered expert may be found or made to order who will differ from those who have already spoken. This is worse than folly; it is silliness; it is criminal trifling.

There is not a single civil engineer in America who has had the experience, the scientific training, and the familiarity with great hydraulic works which the eminent men possess who have put themselves on record in favor of the Quaker Bridge Reservoir. A half a hundred smaller fry might perhaps be induced, for a consideration, to give "expert" opinions against it, but they would be worth nothing, and they would effect

nothing except the delay which place-holders desire and their tools, either designedly or ignorantly, ask for.

THE FACTS ABOUT THE BAD WORK ON THE NEW CROTON AQUEDUCT.

THE accounts recently published of bad work on the new Croton Aqueduct, and the reports that the Comptroller had sent his engineer to examine the work and report on its condition before any more money would be paid to the contractors, have alarmed the public, who, very naturally, have concluded that the discovery of this work was the result of the recent legislative inquiry and that the end was not yet. And the daily papers have concluded that the three commissioners appointed by the last Legislature were in a measure responsible for it. If this were so it would at once suggest itself to our readers that the engineers and inspectors on the work were grossly inefficient and corrupt in not calling attention to it. It is gratifying, therefore, to be able to print the following report by Chief Engineer B. S. Church and Deport of the state o uty Chief Engineer George S. Rice, by which it will be seen that the engineers have done their duty, and have been fully sustained by all the commissioners when they were made acquainted with the facts; and since so much has been said about O'Brien & Clark in the daily papers, it is only fair to call attention to the fact that this firm have done their work well, and when defects have been pointed out have promptly and cheerfully done all in their power to meet the demands of the engineers. Engineers Church and Rice, under date of May 9, say:

Hon. James C. Spencer, Chairman of the Aqueduct Com-

missioners:

DEAR SIR—In accordance with your request, we respectfully make the following report on the "bad work" found on the line of the new aqueduct.

The new aqueduct, from Croton Lake to One Hundred and Thirty-fifth Street in New York, consists of over thirty miles of aqueduct, mostly in tunnel, and the work has been let in fifteen different sections to six firms of contractors—viz.: Smith & Brown, Brown, Howard & Co., O'Brien & Clark, Heman Clark, John Brunton & Co., and R. A. Malone.

O'Brien & Clark, Heman Clark, John Brunton & Co., and R. A. Malone.

This work is in charge of five Division Engineers, and no serious trouble was had until about the early part of October, 1887, when the engineer in charge of the First Division made frequent reports that the work on his division, done by Brown, Howard & Co., was being slighted.

The Chief Engineer delegated the Deputy Chief Engineer to look into this matter, and he found that there was apparently an organized attempt to construct the rubble masonry backing in an imperfect and unsatisfactory manner, and he so reported to the Chief Engineer.

Work was constantly being condemned and torn down, but on account of the general bad character of this rubble masonry, it was suspected that a large amount of work must be bad and unacceptable.

On November 17, 1887, the Chief Engineer notified Brown, Howard & Co. that if the "bad work" was not stopped he would refer the matter to the Aqueduct Commissioners. No attention was paid to the order as far as the quality of the work was concerned, and the Chief Engineer reported to the Committee on Construction on January 4, 1888, that Brown, Howard & Co. were dis obeying the orders of the engineers and allowing unsatis factory work to be done.

An amount of over \$20.000 was deducted from the esti-

obeying the orders of the engineers and allowing unsatis factory work to be done.

An amount of over \$20,000 was deducted from the estimates for Sections 2 and 3 for the months of December, 1887, and January, 1888, and the Committee on Construction passed a resolution on January 9, 1888, approving of the course pursued by the Chief Engineer.

On January 16, 1888, the Committee on Construction received several communications from Brown, Howard & Co., stating that they were not being treated fairly and requesting a hearing.

The Committee authorized such a hearing and referred the matter to the Chief Engineer, Deputy Chief Engineer,



and Principal Assistant Engineer, with instructions that the Deputy Chief and Principal Assistant should conduct the hearing and report to the Chief Engineer without recommendation, after which the Chief Engineer should

recommendation, after which the Chief Engineer should report to the Committee on Construction.

Fourteen meetings were held in Tarrytown, N. Y., commencing January 23, 1888, and ending March 6, 1888. It soon became apparent that Brown, Howard & Co. were intentionally prolonging the taking of testimony, and on February 20, 1888, at the request of the Chief Engineer, the Committee on Construction authorized the cutting of holes into the mason work, and the suspected "bad work" was discovered on March 5, 1888.

On March 14, 1888, the Chief Engineer reported that contractors Brown, Howard & Co. were executing their contract for Sections 2 and 3 in bad faith and that he suspected the work on Sections 4 and 5 was not good.

pected the work on Sections 4 and 5 was not good.
On March 20, 1888, the Committee notified Brown,
Howard & Co. to appear before them on March 22, 1888, and show cause why the contract for Section 2 should not be taken from them.

On April 10, 1888, the Chief Engineer reported to the Committee that Brown, Howard & Co. had signed a document offering to make good, at their own expense, the defective work on Section 2.

On April 17, 1888, the repairing of the bad work was commenced and the work has continued to date.

commenced and the work has continued to date

An examination of the whole line of the Aqueduct has been commenced, and some holes have been cut on Divisions 3 and 4, and will soon be cut on Division 2.

As most of the masonry work has been done under-ground, both day and night, it has been a serious matter to stop bad work, and a large amount of trouble has been occasioned by poor inspectors, who have been discharged as soon as found incompetent and unreliable; twenty six have been discharged or suspended since November 16, 1887

Outside of Brown, Howard & Co.'s contracts, the amount of bad work discovered has been small, less than \$5,000 in value, and where any bad work has been found there has been an earnest effort to repair it immediately.

No final estimate has been made on the 15 Sections, and before any of them are made the work will be

thoroughly inspected. Yours truly,
B. S. CHURCH, Chief Engineer.
GEORGE S. RICE, Deputy Chief Engineer.

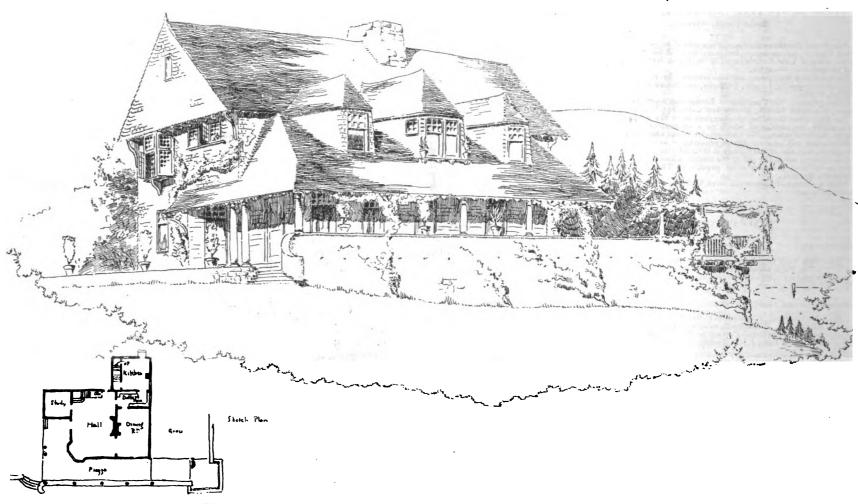
It will be noticed that there has been great difficulty in securing enough good inspectors and that twenty-six have been discharged since November, 1887.

The inspectors, under the law, are appointed by the Commission after a Civil Service exami-

ASPHALT PAVEMENTS IN NEW YORK AT COST OF PROPERTY OWNERS.

WE have frequently urged the trial of asphalt pavements properly put down on some of the residential streets of New York, pointing out the advantages of this noiseless and cleanly pavement as recorded in the experience of other cities. It was with considerable satisfaction, therefore, that we noticed in a recent ride on the west side in this city, where so much building has been in progress, that on West End Avenue and Seventy-second Street the enterprising property owners had contracted with a responsible company who had laid this pavement. quiry we learned that some thirty different owners have co-operated in this matter, Messrs. W. E. D. Stokes and W. J. Merrill, who own a number of buildings in the locality, having been the active promoters of the movement.

The excellent appearance of the street will doubtless enhance the value of their houses more than it has cost the owners. We hope the



COTTAGE ON LAKE GEORGE FOR E. LUTHER HAMILTON, ESQ.-J. D. HUNTER, ARCHITECT, N. Y.

On Section 2 about 500 holes have been cut through the brick and rubble masonry and about 80 per cent. of them have shown bad work.

From what has been disclosed by the examination the

city has been fully protected by the amounts kept back on the estimates, as will be seen by the following:

SECTIONS 2 AND 3, NEW AQUEDUCT.

	Ten per cent. retained as per contract.	Additional amount re- tained for bad work.	Total amount retained.	
October 31, 1887	\$324,304.88	\$1,610.00	\$325,914.88	
November 30, 1887		20,293.50		
December 31, 1887		21,025.00	395.552.73	
January 31, 1888	398,899.41	22,377.50		
February 29, 1888 March 31, 1888	No estimate.		627,069.51 760 ,8 95.71	

From the above it will be seen that as soon as bad work was discovered the estimates for February and March were withheld, and on March 31, 1888, the actual amount withheld from Brown, Howard & Co., on their contracts, was \$1.041.614.41.

nation, which is of little value in determining the capability or honesty of an inspector of masonry, and which in this case has often resulted in delays in securing inspectors when needed. Frequently the force of inspectors has been inadequate, and the engineers have been assigned to temporary duty as inspectors to tide over Many men who would make good emergencies. inspectors of masonry cannot pass the city Civil Service examinations, while it is a fact that men have passed who knew nothing of masonry. Inspectors, we learn, are now examined also by the engineers, and in view of what has transpired we apprehend no more bad work, since the action of the Commission in supporting their engineers and not yielding to pressure to remove them or change their stations has had and will have a wholesome effect in maintaining discipline and efficiency.

fact may speedily be demonstrated so that the example they have set may be followed else-

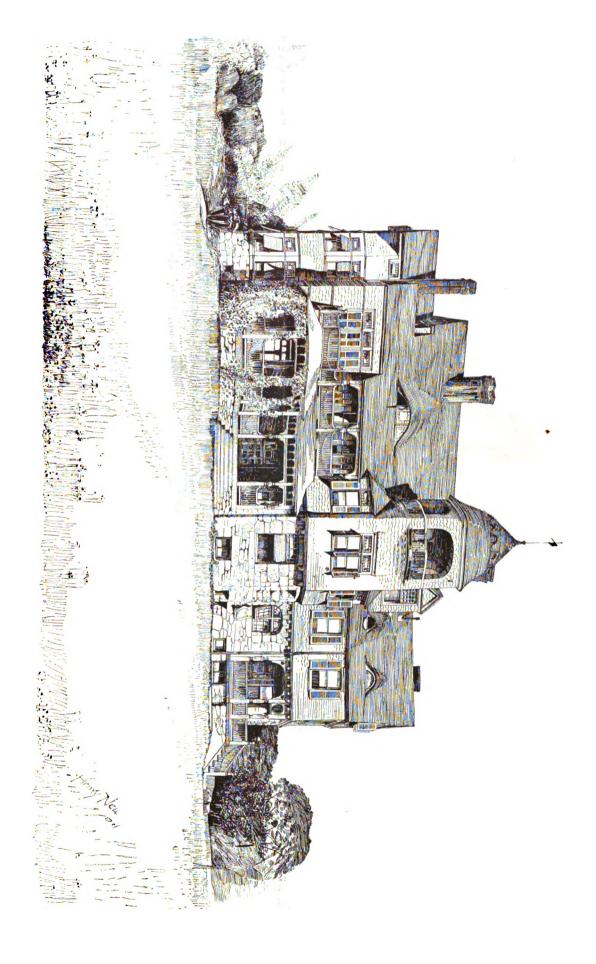
OUR ARCHITECTURAL ILLUSTRATIONS. RESIDENCE OF ULYSSES D. EDDY, ESQ .- E. A. SARGENT, ARCHITECT.

COTTAGE OF E. LUTHER HAMILTON, ESQ. -J. D. HUNTER, ARCHITECT.

PARK COMMISSIONER TOWLE.

THE appointment by Mayor Hewitt of Stevenson Towle, Mem. Am. Soc. C. E., as a Park Commissioner of this city is to be thoroughly commended. Mr. Towle was for many years Chief Engineer of the Department of Sewers. He resigned when Mr. Squire was Commissioner of Public Works. For a number of months he has been traveling abroad investigating municipal engineering methods. His training, experience and character will make him a useful





RESIDENCE OF ULYSSES D. EDDY, ESQ., MAMARONECK-ON-THE-SOUND, N. Y.

ERRORS IN CONSTRUCTION.*

I HESITATED to address the League on the subject I am about to present, but in considering my experience in the bureau, the difficulties I must continually grapple with, and the extra amount of labor devolving upon and required of the employes of the department, through want of knowledge of the laws of construction on the part of architects, I concluded to present my case and hope my proposed remedy will meet with your approval.

My connection with the bureau dates back to February, 1885, and in the three years which have passed since

then, 12,921 applications, representing an estimated value of \$191,105,440, have been submitted for action. The great majority of these have passed directly through my hands, and fully seventy-five per cent. thereof were disap-proved, many for defective and unintelligible drawings, more for defective forms of construction. In presenting some of these defects it would be well to group them in accordance with the materials in which they occur and in the order of their frequency. The greatest number of errors were found in iron constructions, then follow those in wood, and finally those in masonry.

The number of dangerous and remarkable constructions

The number of dangerous and remarkable constructions is legion. I regret extremely not to have kept a record of these matters, and to be obliged, therefore, to draw upon my memory for particulars. Numerous defects are due to unfamiliarity with the requirements of the building law and do not fall within the scope of this paper. Such errors are, as a rule, easily remedied.

Taking the first group, we have those in iron. The engineer's device, the I-beam, is often unscientifically employed the various tables furnished by the iron mills

oyed, the various tables furnished by the iron mills becoming as poison in the hands of children. Again and again girders made of exactly the same beams are specified to carry loads varying by thousands of pounds, at other times like beams are loaded with like loads—some uniformly distributed, some concentrated at the centre; the fact that a beam if loaded at the centre will carry but half as much as if uniformly distributed being seemingly unknown to the designers. I have half a dozen cases in mind where brick partition walls over halls were to be carried by iron beams, the loads being directly at the centre, and the required amendment read: "Use twice as many iron beams as shown." In one case the builder coolly omitted the iron beams and carried a 12-inch brick wall 40 feet high in the centre of a 38-foot house on wooden cantilevers.

Again, some weeks ago, a set of plans was submitted showing a girder made of two 15-inch heavy beams, to carry in turn one made of two 12½-inch beams, the load on the latter to be transferred to the 15-inch beams at a point some three feet from the wall. The 15-inch girder was exactly sufficient, yet it was the intention of the architect to frame the 12½-inch beams into the 15-inch girder, so that but one of the beams composing the same would have carried. Only a week ago plans were filed for a large and costly building, in which it was intended to carry the walls of the front on iron columns and girders. Some of the openings required girders 15 inches high, so the architect concluded to use 15-inch beams for all the openings, thus showing a uniform height of girders at the front. Three 15-inch beams being unnecessarily large for the smaller openings, the girders were made of one 15-inch beam and 10½-inch and 12½-inch beams. To subject the iron in the different members of these girders to the same uniform strain would be impossible, and a failure would certainly have taken place in the course of time. Often extra light and deep beams have been proposed for very short spans instead of heavy shallow beams.

Numerous examples of defective plate-girder construc-

Numerous examples of defective plate-girder construction can be found in the archives of the bureau, the defects generally consisting in improperly disposed stiffeners, too great a pitch of rivets, no allowance for punching, heavy webs, light cover-plates, etc. I call to mind a double web plate girder submitted last week. It is to carry quite an ordinary load on a span of some 18 feet, yet the webs are specified % of an inch thick each, when 3% of an inch would be ample. I shall not take the trouble to bring this to the architect's attention, as on a previous occasion a similar suggestion elicited the unscientrouble to bring this to the architect's attention, as on a previous occasion a similar suggestion elicited the unscientific answer that it was desired to be entirely sure of the girder's capacity. Through the ignorance of the designer the client was therefore subjected to an unnecessary expense. Another case: a large plate-girder was lately submitted where the load upon it subjected the iron to a fiber strain of 30,000 pounds, so that the construction would surely have failed.

The use of the I-beam in the shape of cantilevers is less frequent, but I have a number of such constructions in my mind which, if allowed, would have brought about

less frequent, but I have a number of such constructions in my mind which, if allowed, would have brought about serious accidents. On one occasion the architect was requested to state the size of the beams he proposed to use, to which he replied "that that was a matter for the iron man and the iron inspector, and the neglect to furnish the data at that time should not be a reason for refusing approval." Last fall I pointed out to another architect the fact that the girder he proposed using was insufficient to carry the imposed load, and when convinced of the correctness of the bureau's position he proposed to build in an iron beam in the story above, quite forgetting that this single beam would have been subjected to a breaking strain, and that the original load would again that this single beam would have been subjected to a breaking strain, and that the original load would again rest on the girder below. In very many instances iron columns of insufficient diameter and thickness of metal are proposed, but I believe these errors are rather due to the fact that the designer has assumed a lighter load than permitted by law, than to a wrong application, of the tables and formulas for iron columns. Iron roofconstructions, true subjects for the engineer, rarely show

Since last July the building law requires that all lightshafts be constructed of fire-proof materials. They are therefore generally constructed of fire-proof blocks, sometimes starting on foundation walls, but more generally on iron beams. These shafts, located with reference to the sanitary arrangements of the building, frequently bring about quite complicated systems of framing and loading, and the bureau is again and again called upon to suggest the size and weight of the iron beams.

the size and weight of the iron beams.

Leaving the iron constructions, let us pass to the second group—constructions in wood. Beams and girders are generally of ample size. Columns, on the other hand, are rarely too large, generally too small. Curious errors are made in them, showing a lack of knowledge on the part of the designer as to the strength of the materials and as to the factors of safety demanded by law and practice. The most common error is the one of making the lower columns too small, the upper ones too large. What excuse on the score of strength can there be, for instance, for columns too small, the upper ones too large. What excuse on the score of strength can there be, for instance, for making the columns of the same size in several superjacent stories? And yet such cases are not infrequent. Constructions are occasionally proposed where yellow pine posts would have been subjected to a pressure of over 2,000 pounds to the square inch.

Although permission has several times been asked, no permit has been issued to allow the placing of iron columns over wooden ones. How many such constructions have been carried out in former years I do not know, but I believe there are many. This method was employed in a certain school building, the iron columns in the first story resting on the wooden ones in the cellar—the latter columns reaching below the cellar floor. In the course of time the foot of one of the wooden columns had so thoroughly rotted as to let the iron column next above settle sufficiently to sever its connection entirely with the girder over it, a position it retained but for a few moments, and then came toppling over, causing a panic in a crowded room, but, fortunately, killing no one.

Large roof constructions are not attempted, as a rule, by any but competent men, and yet examples of dangerous constructions are not wanting. A tie-rod or a strut will be forgotten, a member introduced to take a thrust where a pull only will be possible, etc. Trusses have been submitted where the strength of the same depended upon the stiffness of the joints. Take, for instance, the truss which recognizes of the plant at the presenting of the plant. mitted where the strength of the same depended upon the stiffness of the joints. Take, for instance, the truss which spans the proscenium opening of the old Union Square Theatre. Here is a queen-post truss with the struts omitted. One might say of this truss that it is in a sort of unstable equilibrium, and in danger of collapsing in case of unequal pressure.

Plans for a building were once filed where the clear span between bearings was sixty feet. The roof-trusses over this room were each to be made of two main rafters, a tie-beam, two struts, and a king-bolt. The architect not being sure of his ground, gladly accepted the bureau's suggestions and constructed a substantial truss. In a hospital building fault was found with the size of the floor-beams for the proposed span, to remedy which the architect specified a lattice-girder four feet deep—strong enough, to be sure, a girder 14 inches deep only being

required.

We now reach the last group—constructions in masonry. In the thickness of walls many errors are made, but I attribute these to a want of knowledge of the requirements of the Building Act. Not so with piers, in the design of which many, very many errors are committed. Piers with battering sides are submitted tor approval with insufficient area at the top and excessive area at the bottom, piers with plumb sides of sufficient area capped with granite with plumb sides of sufficient area capped with granite cap-stones of smaller area, and piers of ill proportion between height and thickness, the development of bending moments being quite forgotten. These and many other errors are of daily occurrence. Application was made in the month of March to remove a fore-and-aft partition-wall and repiace the same by piers, columns and girders. The columns and girders were found ot ample size; not so the piers in the cellar, which were specified to be 16 x 16 inches. The first story columns were to be of iron and of sufficient size to carry 125 tons. If these piers had been built of the best of brick in Portland cement they would have crumbled under the excessive load. Piers 36 inches square were required and accepted without remonstrance. The error of not properly proportioning the area of the base to the area not properly proportioning the area of the base to the area of the pier is a common one. The law provides that the base course must project at least 12 inches on all sides beyond the various faces of the piers, and in certain cases double base courses are required. Now, one architect invariably puts down two courses of stone, each course 10 inches thick, with a projection of 12 inches on all sides. Here is a waste of material. A few others project each course 12 inches, an error in itself, bringing about so excessive a spread of base as to prevent a uniform settlement of the

walls and piers.

When I took charge of the bureau, it was the general custom to make use of the running foundation walls for taking the concentrated loads carried by iron columns. Such walls are generally built of stone, and, as you all know, are hardly better than a very coarse concrete. I therefore insisted upon piers under all points where concentrated loads were to be supported, such piers to be built of brick or dressed stone. I desire to interpolate here, however, that if stone piers are proposed in the cellars or subcellars of buildings, I request that they be built of brick that the entire building may not be let down in case of fire, endangering the lives of the firemen, many of whom have been maimed and killed through such collapse. Brick piers under concentrated loads are now quite

the rule, and I believe fewer serious settlements will hereafter be recorded. In building piers under concentrated loads the mistake is frequently made of not properly centering the iron columns over the piers.

It would seem that every architect of our generation should know that piles must be cut off below the level of low water, and timbers, where used in the foundations, continually submerged, if permanent stability of the structure is aimed at. But the defective constructions of this class, proposed and executed, are so many that we are ever on the *qui vive* at the bureau. Two weeks ago an application was made for a two-story office building. In the rear was a solitary 6-inch diameter locust post supporting an area of some 300 square feet of floor and a like amount of roof area. Under this insufficient post a 2'8"x2'8" brick pier was proposed. The disproportion is too evident for comment comment

The arch, in its fullest development, is a pretty well neglected element of construction with us, but I believe and hope it is coming into favor again. The number of errors noticed are comparatively few. One gentleman who practices our noble profession answered, when asked who practices our noble profession answered, when asked how he proposed overcoming the thrust of his arch, "by increasing the number of rowlocks." An example of some large arches was submitted the past winter where no provision had been made for the balancing of the thrusts—at least the drawings revealed none. Upon calling attention to this fact the architect explained that he intended placing girders over the arches and when asked to specify their size he selected insufficient beams. I objected and argued that they would bend and break, being entirely inadequate, while he contended that the girders would help the arches and the arches the girders. He had forgotten that the strength of a chain is measured by the strength of its weakest link.

Finally, I desire to tell of a remarkable proposition made Finally, I desire to tell of a remarkable proposition made to me some two years ago. A permit was issued for the erection of a two-story factory, the outside walls being resolved into isolated piers, these piers carrying in part the upper walls, the second-story floor and the roof. The piers measured 20x36 inches and were of sufficient size. Work was commenced and duly carried forward, and when the second story had been finished the owner decided and the property and made application accordingly. The add another story and made application accordingly. The request was denied. Convinced of an injustice being done request was defined. Convinced of an injustice being done him, he left the office in a highly excited state of mind and proceeded to his architect. After a week or so he returned with a formidable set of calculations and proceeded to demonstrate my error. I question whether any one could guess his results. It was a revelation to me. The piers guess his results. It was a revelation to me. were built of brick, with bluestone binders and granite caps, and he assumed for their safe compressive strains

caps, and he assumed for their safe compressive strains per square inch 200 pounds for brick and 2,000 pounds each for bluestone and granite. Then the area of the piers being 720 square inches the brick would carry 144,000 pounds, the bluestone 1,440,000 pounds, and the granite likewise 1,440,000 pounds—ergo, each pier would carry their sum total amounting to 3,024,000 pounds!

At the beginning of this paper I made the statement that fully 75 per cent. of the various applications filed at the bureau were disapproved. Now this means that about 3,000 applications were found defective and required amending in the course of each year, and in the time that I have been connected with the bureau the number of these defective plans and specifications has quired amending in the course of each year, and in the time that I have been connected with the bureau the number of these defective plans and specifications has reached the large figure of 10,000. That the examination of so many plans represents a great deal of labor goes without saying. If now 75 per cent. of such plans are defective, you more than double the labor of the bureau. This would certainly not be so were ell the applicants competent men. But under our laws no restraint is placed upon those who desire to parade themselves as architects. Anybody may sign himself as such and begin the construction of a building, unconcerned whether the lives of human beings are thereby imperilled or not.

The number of defective constructions submitted instead of being as rare as the oases of the desert are as common as its sands. The large majority of plans are not presented by our prominent and capable architects, with whose work little, if any, fault can be found, but by men who know something of drawing and less of construction.

I think the days have passed when the rendering of a drawing is all that is required of an architect. We are of an era in which buildings are erected, the intricacy of which in former times no one dreamed of. The most economic use of materials is demanded, and the strains to which they may be subjected are carried to the utmost limit.

which they may be subjected are carried to the utmost limit. It is my idea that laws should be passed aiming at the control of this dangerous liberty—in short, licensing of architects. Why if physicians are licensed should not architects and engineers be subject to similar laws? I know I will be met with the assertion that we suffer from know I will be met with the assertion that we suffer from too many laws already, but I contend that as of a good thing we cannot have too much, so of good laws a people can never have too many. The subject is receiving much attention in England, a lead we will sooner or later be forced to follow. Responsibility ought certainly be centered somewhere, and the architect, as the designer, is the one who should be held to account if an accident occurs. I also believe that the men who design a building should superintend its erection.

The capable architect need surely not fear restrictive measures; such measures should be on the statute book, and the League should draft and present them to the Legislature at the opening of the next session. To the architects belongs the initiative in this subject, and if they

and the League should draft and present them to the Legislature at the opening of the next session. To the architects belongs the initiative in this subject, and if they should decide upon some such course of action as is here outlined the profession and the country would be the



^{*}Paper read by Mr. Albert F. D'Oench, Superintendent of the Bureau of Inspection of Buildings, New York City, before the Archi-tectural League of New York.

BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXXIII.
(Continued from page 324.)
ERECTION OF POUGHKEEPSIE BRIDGE.—No. 3.*

FALSE-WORK.

In the stone-yard on shore an efficient arrangement was resorted to by the contractor to avoid the necessity of a very large derrick. A platform about 40x60 feet was framed of heavy timber mounted on trucks and provided with a tramway the whole length of the yard; a mast and boom derrick in the middle of the platform bed had a swing reaching beyond each side, and could raise material at any point, pile up a large quantity on deck, and then run over to any other place and unload it. This arrangement

proved satisfactory and economical.

When the masonry had been completed the erection of the iron-work required a most lofty, extensive and elaborate system of false work, whose most notable features only are here outlined. The huge frame-work of beams, columns, and braces rises more than 130 feet above the water and is over 500 feet long and 100 feet wide at the base, presenting a most imposing appearance, both from a distance and when inspected from the top of the 100-foot traveler which surmounts it. The arrangement, proportions, and details are carefully designed and well carried out and the determination to secure absolute solidity is apparent and successful.

The requirements of the design necessitate false work to support all the trusses of the superstructure except the three large cantilever spans, which are self-sustaining during erection.

Braced timber trestles were accordingly erected for the 201 foot shore spans, which were built and anchored. Then false work was put in between piers 2 and 3 and the triangular truss span of 525 feet erected upon it. Then the 548-foot cantilever span between piers 1 and 2 was built out and connected up. The false work is now being removed and re-erected between piers 4 and 5 so that span can be built and the remaining two cantilever spans completed, forming the whole superstructure.

Figures 12 and 13 show a section of this main false work, which contains about 2,000,000 feet B. M. of first quality hemlock timber and plank.

The weight it had to carry was about 4,000,000 pounds of the superstructure, to which may be added 300,000 pounds for approximate weight of travelers, engines, tools, etc, besides its own weight estimated at 10,000,000 pounds.

The false work was required to sustain this load (the highest point of which was nearly 250 feet above the water), to resist swaying, lateral motion, and the racking and concentrated strains of hoisting 70,000 pounds at one point, to have stability against wind-pressure and the force of the current, sometimes swift, swollen by tides and freshets, and likely to carry ice, rafts, etc., and to remain practically inflexible, not settling enough to cause much displacement when the distortion should be multiplied by the height of the structure.

The cross-section of the channel shows first about 50 feet depth of water, then 20 feet of mud, 45 feet of clay and fine sand, 17 feet of sand and gravel, and then rock. Two 60-foot piles, 15 inches in diameter, were spliced and driven nearly to the water's edge in transverse rows of 24 each; these were tied with horizontal stringers just below the water-level and by a double cap on top and cross-braced between. The bents were connected by similar longitudinal bracing at their ends. On top of the caps the trestle bents of eight batter posts each were raised in

five tiers to a height of 120 feet and securely connected with horizontal stringers and cross-bracing in every panel transversely, and in most panels longitudinally. Each batter post was supported by a group of three piles, and the lower chord of the truss was supported at each point by three batter posts, one of which, together with outside batter post, supported the traveler-track. The timbers were all fastened with $\frac{1}{2}$ bolts driven into $\frac{1}{2}$ -inch holes. The posts were all spliced with side plates. Figures 15 and 16 show special framing of bents that rest on the piers.

Figure 14 is a cross-section of false work under east shore cantilever span; the lower sill is supported on the ground and the bents are left in after the erection of the truss span until it receives stability by connection with the rest of the structure.

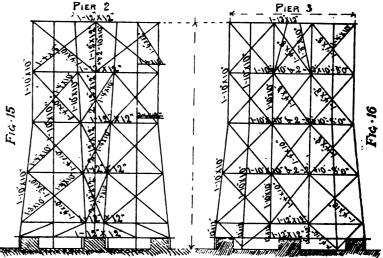
(To BE CONTINUED.)

STREET-WASHING MACHINE.

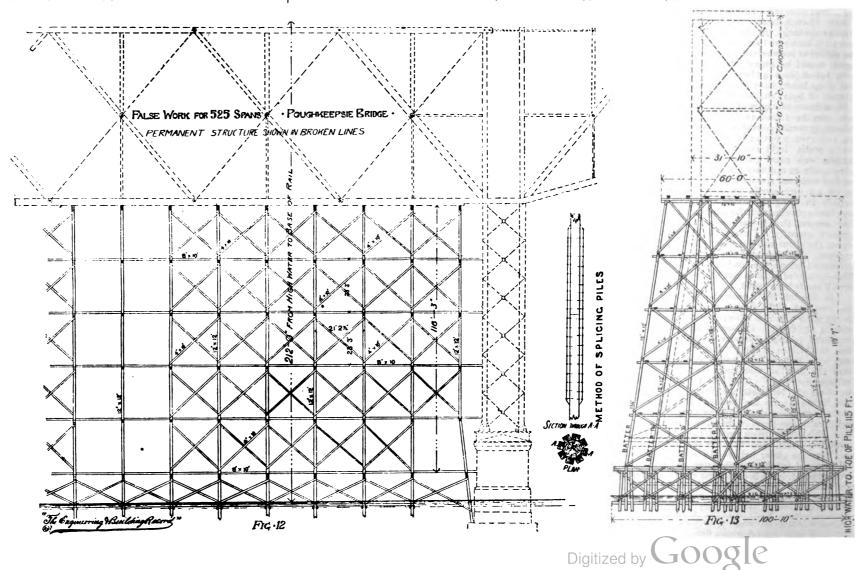
A RECENT number of *Uhland's Technische Rudschan* contains an illustrated description of the street-washing machine of A. Hentschel, of Berlin. It is a combined sprinkler and sweeper, drawn by two horses. The sprinkler

is in front and at the rear is a revolving brush or cleaner.

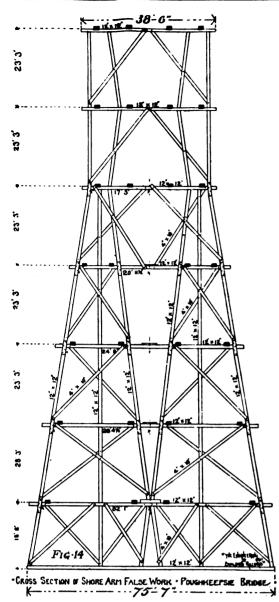
It suggests incidentally that the Berlin pavements must be in very good condition, as such a machine would otherwise be of very little use.



· DIAGRAM OF SPECIAL BENTS OF FALSE WORK · POUGHNEEPSIE BRIDGE ERECTION ·
· NOTE — ALL SQUARE TIMBER HEMLOCK · PLANK SPRUCE ·



^{*}No. t of these articles, containing the General Description and an account of submerged work, appeared in our issue of March 3; No. 2, Masonry, issue of May 5.



ABSTRACT OF PAPER ON STAND PIPES FOR WATER-WORKS.*

HAMMERING impairs the tensile strength of metal and changes its structure.

Crystallization of iron or steel in a stand pipe may be

caused by the perpetual vibration and silent hammer-blows of the moving water, and an unusual strain will cause sudden rupture

So far as known there are 282 stand pipes and water-works tanks in the United States.

A stand pipe on a hill may economically store water for high service, but for both low pressure domestic use, and high pressure fire service, a tall stand pipe of smaller cliameter, constantly filled, is more economical and effec-

For supplying 10,000 inhabitants an open stand pipe, furnishing a water-cushion to pump against, is better than a direct pressure system, and if the water in the lower half of the pipe is not good for much else it makes excellent ballast.

It is practicable to build stand pipes 350 feet high, and they should be self-supporting and maintain their position by their own inherent strength.

Practical Suggestions.

Stand pipes should be near the pumps. They should not have cast-iron nor steel bottoms, nor steel angles nor rivets. They should have wrought-iron bottoms with brackets riveted to outside lower courses.

The best width of plates is that giving 5-foot courses. The thickness and length of plates should vary with the diameter and height of the tower, and be proportioned so as to make an increase in its height permissible.

All holes should be drilled perfectly true.

Where three plates join the overlap must be scarfed down hot, and no fulling tool allowed at such points.

The manhole cover and frame should be of wrought-

iron in the most convenient position on the side.

The inlet and outflow should, when possible, be through

The inlet and outflow should, when possible, be through the same pipe.

The inside of the stand pipe should be kept free and clean of all obstructions and accumulations.

Anchors and guys are unnecessary. The material should be first-class iron, with liberal amount of angle iron.

A conical galvanized iron cover is unobjectionable if provision is made for circulation of air.

Freezing is prevented by air-spaces above and below, made tight by grouting the floors.

made tight by grouting the floors.

Frequent pumping and changing the water at intervals of 8 or 10 hours is a certain preventative of freezing in the severest cold.

Asphaltum paint is the best.

Aspnaltum paint is the best.

Even with the clearest water large quantities of sediment accumulates in the bottom of the pipe and should be cleaned out. Its removal by hand is difficult, slow and expensive, and the necessary emptying of the pipe is very hazardous. The author has patented and used for several rears a device for cleaning out the sediment while the years a device for cleaning out the sediment while the

pipe is full of water.

A horizontal sediment pipe reaches from the centre of the tank, through the side near the bottom, to any convenient drain or sewer. The pipe is provided with a valve, and the inner end bends vertically downwards and valve, and the inner end bends vertically downwards and terminates in a large conical mouth, very flaring, whose serrated edges are close to the bottom plate of the tank. The tank being full of water it will rush out with great violence as soon as the valve in the sediment pipe is opened, and as it enters under the cone the current stirs up and sucks in the sediment and carries it all out in 5 or 10 minutes. This arrangement is cheap and effectual, and has given complete satisfaction:

DESTRUCTION OF STAND PIPES

Lexington, Miss.—Collapsed June 22, 1885; 365,000 gallon stand pipe, 22 feet diameter by 152 feet high, made of 1/2-inch iron, supported by 10 cast-iron columns, 40 inches diameter, 50 feet high. Supplied the city for several weeks and burst when full, scattering material as if exploded.

Victoria, Tex.—16 feet diameter and 100 feet high

Victoria, Tex.—16 feet diameter and 100 feet high; lower 70 feet ½-inch iron, remaining 30 feet ¾-inch thick. When containing 70 feet of water was struck by a tornado blowing 80 miles an hour, which caused an oscillation, buckling and collapse of the 30 feet of empty tank. Gravesend, N. Y.—(Described on page 404, Vol. XIV.) Newport, Ark.—Wooden tank burst with great damage. Caldwell, Kan.—Collapsed while being built in 1887; was 12 feet 6 inches diameter by 150 feet high; it doubled over about midway, breaking part of foundation like the uprooting of a tree.

while empty, March, 1887.
Cincinnati, O.—Steel too light and it burst; a total

Belleville, N. J .- 100 feet high by 6 feet diameter, and

's-inch thick.

Franklin, Mass.—(Described on page 643, Vol. XVI.)

Seneca Falls, N. Y.—(Described on page 683, Vol. XVI.)

Thomasville, Ga.—Collapsed, December 10, 1887, before completion. Erection scaffolding had been built to serve as a brace between solid brick centre pier 6 feet in diameter, and outer walls. In hoisting brick to top of

tower the pier was swayed and overthrown.

Houston, Tex.—Circular foundation wall with crosssections settled under pipe, 20 feet diameter by 74 feet

Kankakee, Ill.—Steel, 20 feet diameter by 120 feet Collapsed and blew over, breaking off anchor

DISCUSSION OF PAPER ON STAND PIPES

Did not the conical reduction of the Gravesend stand pipe effect its destruction?

Mr. Stephens—No, sir; it was well braced and riveted. Q. Was it not on account of the upward turning of the bottom at the outer edge that the braces were put on?
Mr. Stephens—They were put on on account of a little

tremulousness in the structure, and because of the appearance of an opening large enough to insert a knife blade in.

The braces were placed at the cone, and at the bottom from the base up to the second and third courses.

Q. Were these braces beneficial? I think that the

pressure on them might prevent the distribution of strains

pressure on them might prevent the distribution of strains and defeat their purpose.

Q. How was this stand pipe erected?

Mr. Stephens—By a scaffold. There has been much recent improvement in building stand pipes. At first one staging cost \$800; now they are erected from an interior cage that costs \$30.

Mr. C. A. Judson—We lately built one at Sandusky, using an inside platform that floated on the water pumped in as fast as the sides rose.

fast as the sides rose

e have a double stand pipe providing simultaneously for fire and domestic supply. It consists of two concentric cylinders, the outer one 25 feet by 180 feet, and the inner one 3 feet by 225 feet, giving about 100 pounds pressure when full.

Both pipes are without bottoms, their lower edges being fitted to the solid limestone rock to which they are anchored by outside bolts. The inside pipe is braced to the outer one, and has a check valve preventing the escape of water into the large pipe. When necessary the ice around the small pipe is melted by a steam pipe.

PRACTICAL RESULTS OF MECHANICAL FILTRATION.*

BY W. G. RICHARDS.

THE filter plant at the Atlanta Water Works consists twelve Hyatt filters ten feet in diameter, thirteen feet th. The filters are cylindrical, and are placed on end in two rows, the main supply-pipe passing between them,

the centre of the pipe being eight inches below the centre of the filters, or about five feet above the pavement of the

The filters are divided into two compartments or sections; the lower section is the filter proper, the upper section being used for the purpose of washing the filter-ing material, which is sand and coke, in the proportion of

about three parts sand to one part coke. In the proportion of about three parts sand to one part coke.

The sand used is of a good sharp quartz, and the coke is the ordinary coke that is taken from the smoke-box of a locomotive, and passed through a sieve of about a quarterinch mesh. The depth of the filter-bed is kept at about

The material of which the filters are constructed is The material of which the filters are constructed is ordinary boiler-plate, the lower section $\frac{1}{16}$ -inch thick, and the upper section $\frac{1}{16}$ -inch thick. The heads, or, more properly speaking, the bottom and the partition in which the valves between the upper and lower sections are placed, are $\frac{1}{16}$ of an inch thick.

The water flows from the impounding reservoir, through

the filters, to a clear water-basin, by gravity; the surface of the water in the reservoir being nineteen feet above the top of the sand and coke in the filters. Within twenty feet of the filters is situated the clear-water basin, into which the water passes from the filters. The average height of the surface of the water in this reservoir is on a level with the bottom of the filters.

The situation of the impounding reservoir in this in-stance was rather favorable for the introduction of a filter The situation of the impounding reservoir in this instance was rather favorable for the introduction of a filter of this description, the pumps being about twenty-four feet below the surface of the water. The suction pipe was cut and a tee inserted, diverting the water by an arrangement of valves from its direct passage to the pumps, through a twenty-inch pipe, and thence, by means of branch pipes six inches in diameter, it is distributed to the various filters. The water in its passage, and before it reaches the filters, passes a twenty-inch valve, which is closed enough to somewhat impede the flow, and cause a diversion of a portion of this water through a ¾-inch pipe to the bottom of an iron reservoir, holding about eight cubic feet of alum in solution. There is another ¾-inch pipe passing from this alum-tank to the other side of the 20-inch valve, where it enters a brass pipe one inch in diameter placed across the 20-inch supply-pipe horizontally and vertically; this cross pipe has a number of holes, $\frac{1}{18}$ of an inch in diameter, through which the solution of alum is discharged into the moving column of water on its way to the filter-beds, so that the water reaches the filters impregnated with the coagulant. After passing through the filterthe filter-beds, so that the water reaches the filters impregnated with the coagulant. After passing through the filter-bed the water enters a number of small copper saucers which are attached to the end of pipes and are filled with copper shot about a tenth of an inch in diameter; the saucers are covered with a piece of sheet copper punctured from the inside with small holes not large enough to allow the shot to pass through. Gate-valves are attached to the inlet and outlet pipes, so arranged that the current may be reversed when the sand and coke are being discharged into the upper chamber for washing. In the top head or partition of the filter are seven 2-inch pipes extending to nearly the bottom of the filter, through which the coke and nearly the bottom of the hiter, through which the coke and sand is thrown into the wash-chamber; there are other valves arranged around these pipes in the partition to admit the coke and sand to the filter-chamber after it has been washed. The clear water is discharged through 6-inch pipes into a 30-inch pipe, which conveys it to the clear-water basin. The filters are operated from a floor which is within four feet of the upper edge of the filters. and the work is performed by two men, one at a time, day and night. The subject assigned me on the programme is "Practical Results of Mechanical Filtration," but, as I am neither an engineer nor scientist, my subject would perhaps have been better stated if transposed, being "Mechanical Results of Practical Filtration." Our impounding reservoir covers an area of fifty-two acres, and the ing reservoir covers an area of fifty-two acres, and the banks are just as nature left them, except that about three-fourths of the timber has been cleared off. The washings are for the most part red clay which is held in suspension to the extent that the water is never clear, its condition being either muddy or very muddy. On the water-shed, which covers an area of at least five square miles, are numerous dwellings, whose washings, notwithstanding they are watched closely by the sanitary force under the direction of the board of health, find their way into the reservoir, so that the water before filtering is very rarely sufficiently clear for bathing or laundry uses. After passing into the clear-water basin small objects are plainly seen through it at a depth of twenty feet, and the bottom is plainly seen by moonlight. I quote from the report of our board of health:

"The sanguine expectations have been fully realized. The clear, sparkling water which has recently supplanted the muddy liquid to which we had become accustomed attests the completeness and value of the work done by the Newark company. The accompanying analysis, made by Mr. John M. McCandless, shows the quality of the water now received after passing through the filters to be unexceptionable. Grains per U. S. gallon: total solids, 3.60; sodium chloride, 0.76; oxygen absorbed, 0.03. Parts per million: free ammonia, 0.08; albuminoid ammonia, 0.03. It is important to understand that the large proportion of free ammonia detected in the specimen is due to the fact that a small quantity of alum is used in this system of filtration as a coagulant. Ammonia is frequently employed in the manufacture of alum as a substitute for potassium; hence, it becomes one of the bases of this salt, and ammonia is liberated when the alum, the sulphate of aluminum and ammonia is decomposed in the Warklyn process of analysis." I personally know but The sanguine expectations have been fully realized

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^{*} Abstract of paper read April 18, at Cleveland, before the eighth annual meeting of the American Water-Works Association, by Member B. F. Stephens.

^{*} Abstract of paper read before the convention of the American Water-Works at Cleveland, O., April 17, 1888.

little of the scientific results. This I know: that it was muddy and now it is clear. The capacity is three million gallons in twenty-four hours. The cost of twelve filters, including the house over them, was \$56,200; filters and clear-water basin was \$55,000; house over filters, \$1,200. We are now filtering an average of about two million gallons per day, at a cost of \$8 for alum and \$2.50 for labor. The quantity of alum required is contingent upon the quality of the water, and as the water contains more mud during the season of heavy rains, we have used perhaps the maximum, as the filters have only been in use since last November. I do not anticipate that the average for a year will be as much as the filter company allows, which is one grain to the gallon. There is but a small percentage of waste of sand and coke in washing, and of this I have made no estimate. I have found but one class of persons, and not many of those, who object to the Hyati filters; these are among the users of steam, who complain that the alum leaves a deposit in the boilers; but they found fault when they were compelled to take out the handhole plates once a week and even oftener, if possible to do so, to remove the mud, and now they find fault if they capacity in always without any trouble to themselves.

oannot run always without any trouble to themselves.

Our engineer at the works has found no fault, and, on the contrary, is much pleased with the water so far. As a matter of course if there be alum, or any other substance in the water, it would necessarily be deposited in a boiler. I am not prepared to say that there is not a small percentage of the alum left in the water after it has passed through the filter-beds; but as the alum is used to coagulate the mud, the greater portion will be found with the

mud, coagulated.

If the water flowing from the filters to the basin were not clear then we might expect with the coloring matter a percentage of alum.

DISCUSSION.

After the reading of this paper the following discussion

Q. Is the full head of 18 feet used on the filter? A. Yes. Q. Would not the water contain more organic matter in the summer? A. Yes. Q. What percentage of the water filtered is used for washing the filter? A. We do not use filtered water, and I do not know how much is required. Q. Does any vegetable growth form on the sides of the impounding-reservoir. A. No. Q. Does ice ever form in the basin? A. No. Q. Is the cost of power for operating the filter included in your estimate? A. No; it operates by gravity, but we lose 19 feet head, and have not estimated that. Q. Has there been an analysis made of the water prior to filtration? A. Yes; it shows much benefit from filtering. Q. What is the use of the copper saucers in the filters? A. They are solely to prevent loss of the filtering material.

THE MUNICIPAL ENGINEER AND THE MANAGEMENT OF HIS OFFICE.*

As CIVIL engineers who have spent their past at railroad work, or some special branch of civil engineering other than city engineering, often find opportunity to enter the municipal service, which will prove a new field to them, the varied knowledge of such of their colleagues as have had experience for years in this special branch of engineering may be of some service. This is the motive for this paper. Another object in view is to induce municipal engineers to communicate their experience to the profession.

The municipal engineer—"city engineer, city surveyor"—is either appointed by the city council, or he is elected by the citizens. In some instances the appointment rests with the Mayor of the city, which appointment is usually subject to the approval of the council, but in most cases the duration of the appointment is limited to too short a space of time to give the engineer the necessary opportunity to so organize and conduct the technical service of the city government as to give the most efficient results. But, be this as it may, his position is much the same, partly that of a counsellor to the city council—consulting engineer—and partly as the chief of the technical branch of the city government—resident engineer. This dual capacity makes it his duty to advise the council and its individual members as to necessary work, contracts, prospective improvements, etc., and upon municipal legislation in regard to such. And it is his further duty to organize and conduct the service of his office so as to facilitate systematic and efficient work in the field and in the office; to make or revise all plans, calculations, estimates, and specifications, and to arrange and direct all the plotting and map work.

and direct all the plotting and map work.

The engineer should never forget that he is not a clerk of the corporation government, but its adviser; that his office is executive as well as initiative, and that his position charges him with greater responsibilities and demands higher abilities than are required of any other officer of the municipal household. While the city attorney, by means of his legal learning, sparkling rhetoric, and shrewdness in managing juries may defeat litigations against the city, the engineer's judgment, based on knowledge and experience, will prevent them; by far the cheaper and wiser modus operandi; and he can do more toward a real growth, proper development and neat appearance of a city than any combination of real estate speculators, city boomers, and party pushers will ever be able to accomplish.

As efficient work can only be expected or made possible through an intelligent arrangement of the entire office and field-work, and the records thereof, it is plain that manifold records are required. In the first place, the engineer must be fully posted as to the laws, ordinances and resolutions having any bearing to the work of his office. Therefore he should keep a record of them, stating at the head of each law, ordinance, etc., the book and page of original record, and giving date of its passage, and a complete and accurate index must be appended. An office day book is another necessary record in which all ordinances and resolutions ordering work done, are entered, giving a short synopsis of what is required; and after the order is executed there should be made an entry on the opposite page, stating all necessary particulars. The engineer should keep a diary in which he should enter every day's doings, peculiar observations, meterological notations, etc. For special work particular records will be required, such as an assessment record for entering each individual assessment against property for improvements, with such general notes as are deemed necessary, estimate book, material register, cement tests register, etc.

It is essential to have a "map" of the municipal territory, showing the government survey, with monuments and references to them, with the subsequent divisions and subdivisions into acre tracts and roads according to the deeds, with short memoranda as to book and page of deed record or road records, monuments, witnesses to them, distances and bearing of boundary lines, etc., and every difference in measurements found—either surplus or shortage—fully marked. In connection with this map, government monuments should be preserved and brought in measurable relations with easily discernible, permanent, objects, and all the old evidence obtainable, as records, statements of witnesses, should be gathered and kept with the map. Another map which is necessary, is a plan of all the additions and subdivisions with the undivided property—corporation land—showing blocks, lots, streets, public squares, parks, and alleys, with numbers and sizes, the names or designation of additions, etc. streets and public places plainly inscribed. The different additions and subdivisions can be made more plainly visible by bordering same with brush lines of different colors, while public land, railroad land, etc., can be made easily discernible by coloring with a definite shade of water color. A scale of 400 or 500 feet to one inch will prove most satisfactory. A copy of the foregoing described plat or map, with the horizontal contour lines accurately entered, will give a reliable topographical map, necessary in considering surface and underground drainage.

In connection with these maps there should be detail maps, say on a scale of 200 feet to one inch, made either in quarter sections (which I found the most convenient) or in consecutive sections of streets, giving additions, blocks, and lots, with names, numbers, and dimensions of same, as also the names of streets, public grounds, etc. These maps are very useful for tax assessors, as well as for special assessments, street improvements, sewers, etc., and the graphical record of public improvements and works.

For the convenience of establishing street grades, of questions as to grading of streets, calculation of approximate quantities, etc., the profile of every street should be entered on a profile book of ruled profile paper. The scale should be large enough to allow figures for elevations, quantities, etc., and for references to the respective level books.

To simplify the work, and still to keep a thoroughly reliable and efficient record of work and results, the level books and different kinds of note books (field books) should be classified by capital letters (A, B, etc.), and each kind should consecutively be numbered each year, commencing with No. 1; and each book should be paged and fully and accurately indexed, so that in entering surveys on maps it will only be necessary to refer to the original record (as, for instance, B., 15, 1886). And each entry in a level book or in any kind of note book should be headed with the date, with a short description of the work as to location and nature, and such observations as may seem likely to be of service.

These suggestions are mainly adapted to the necessities of an engineer's office of small compass—where no board of public works is supporting the engineer, though it is hoped that some of the suggestions in this paper will be of interest to engineers of larger cities, and to members of boards of public works.

[Other maps will also suggest themselves to our readers as of much importance in the office of the municipal engineer, such as a grade map showing in figures the elevation of all street intersections as they are to be and of all changes of grade between them, or still better, the elevation of all curb corners and of all summits or valleys between them. present elevations of the surface at the same points being given in a different colored ink. This can be made with much less labor than the contour line map mentioned in the paper, and will answer the same purpose reasonably well until the latter can be completed, and for some purposes will be even more convenient. There should also be a sewer map showing all mains, laterals, and catchbasins, and a pipe map giving location and size of all water-pipes with stop-gates, hydrants, blow-offs, airvalves, etc. A map showing extent, character, and condition of paving would also be desirable.

Notes of the exact location of all undergrou it work of every kind should be very carefully made as it rogresses, as it is of course very difficult and expensive to the precise location of such work after it is covered, and yet in designing or constructing other undergound work it is often of the greatest importance to know ust where the existing work is. All underground work, we ether public or private, should be carefully recorded at mapped. These records will be increasingly valuable until before long the municipal engineer would rather lose all his other maps than this, which alone cannot be duplicated. Such a map of the underground work of a large city would be almost priceless if complete und accurate, and it can only be made so by commencing it when the city is very small.]

TWENTY-FIRST ANNUAL REPORT (F THE CITY ENGINEER OF BOSTON.

WE have received from Mr. William Jackson is annual report as City Engineer of Boston for the year 1387. He divides his duties under four heads—viz.: Bridg :s, waterworks, sewerage, and parks.

Boston has, perhaps, more bridges than any ity in the Union, no less than 93 of these structures com ng under Mr. Jackson's supervision, of which the city w folly supports 39 and partially 19, while 35 belong to various railroads. Even so far north as Boston 18 piles in a ne bridge were seriously weakened by the Limnoria tere rans and had to be replaced.

The monthly consumption of water has averaged 37,481,000 gallons, varying from 43,176,200 gallons in January to 32,525,300 gallons in April, giving an average daily supply to each individual of 79 gallons.

Here follows a description of the Fisher Hill Reservoir, which we hope to give separately in a subsequent issue.

The Cochituate distribution has been greatly improved by removing the tubercles from the old 6-inch and 12-inch mains by means of the Sweeney pipe-scraper. There were cleaned during the year 40,932 feet of 6-inch and 20,280 feet of 12-inch pipe, at an average cost of 13.7 cents per foot for the 6-inch, and of 20 cents per foot for the 12-inch. The cost per ton of cast-iron pipe has been \$35 for 24-inch, \$34.50 for 30-inch, and \$30.69 for 16 and 30 inch.

The main drainage works, put in operation January, 1884, continue to accomplish all that was expected of them. The daily averages of gallons of sewage pumped were as follows: In 1885, 33.874.575 gallons; in 1886, 36.866,129 gallons, and in 1887, 43.630,657 gallons, varying from 60,612,617 for February, 1886, to 26.625,076 gallons for June of the same year. In 1887 the amount for single days varied from 116,972,611 gallons to 27,796,176 gallons.

The cost per million gallons lifted one foot high was \$0.0585 and the total cost \$32,166.70, of which \$17,334.96 was for labor and \$8,687.48 for coal. A total amount of 15,906,146,275 gallons has been pumped in 1887 to an average height of 34.53 feet by the combustion per 3,444 gallons of one pound of coal containing 11.7 per cent. of ashes and clinkers. The average duty of the engines in foot-pounds per 100 pounds of coal was 99,560,914, varying from 93,782,861 in January to 105,005,278 in April. It is noted that the copper roofs of the drainage buildings have been so corroded by gases from the sewage as to require protection by painting.

A large amount of work has been done in removing from the sewers deposits of gravel and scraping from the side walls accumulations of grease.

PREPARATION OF PARK ROADS.

The following are the methods used in preparing park roads. In the Park Way on the Back Bay Fens the roadways have been constructed in the following manner: The roadbed was carefully graded to 8 inches below the surface of the finished road and thoroughly rolled. The curbstones were first set; the gutters were paved with rectangular granite blocks, for a width generally of 4 feet, the blocks being laid in rows at right angles to the line of curb; the surface of the paving at the curb is 7 inches below the top of the curb, and rises 2 inches in the width of 4 feet. The roadway was then covered with broken stone; the stone was broken to sizes about as follows: for the first 4 inches in depth about 4 inches in diameter; then 3 inches in depth 2½ inches in diameter; then 1 inch in depth about 1 inch in diameter; then a layer of screened gravel or fine stone screenings from the crushers was spread on top; each layer was watered and rolled with a 2½-ton sectional grooved roller. The surface of the roadway has a fall from the centre to the gutter of 1 to 30. The above-described method of road construction is cheaper and less substantial than would be desirable if the conditions were different. It must be understood, however, that the land upon which the roads are built has been but recently filled, and the filling is



^{*}Abstract of paper read before the Western Society of Engineers by B. Schreiner, and published in the Journal of the Association of Engineering Societies.

still settling, and will continue to do so for some still settling, and will continue to do so for some years. A roadway prepared as this has been will last until the filling has reached a firm bearing, when it will be necessary to regrade the surface, and a more enduring foundation can be laid if desired. There is, on the other hand, this to be said in favor of a cheap method of construction in this locality—that the filling being of loose gravel and the surface of the roadway being at all points several feet above the level of the ground water, the subsoil will be well drained, and a light covering of road metal will wear much better than it would under less favorable conditions. Nearly all of the stone used has been purchased by con-Nearly all of the stone used has been purchased by contract, and of such a size as could be received by a stonecrusher. It was suggested at the beginning of the season that the amount of stone received could be more accurately

that the amount of stone received could be more accurately ascertained if it was purchased by weight instead of by the more usual method of measurement in carts. Experience has confirmed this opinion. Scales were set up, and all stone purchased has been weighed.

A stone-crushing plant was purchased and set up near the same point, and the stone has been crushed at a less price than the same could have been purchased, and the rate of crushing has been controlled to suit the work in hand better than if it had been done by private parties.

In the Arnold Arboretum the drive was constructed in the following manner: The roadway was sub-graded so as to allow a depth of one foot for stone, the surface having a pitch of 1 in 20 from the centre to the gutter.

Catch-basins were built on each side of the roadway about 300 feet apart, with outlets on the side hill below the driveway. Tile drains were laid on each side of the driveway, for draining the subsoil; the one on the up-hill side was on the outer line of the sidewalk, while the drain on the down-hill side was on the line of the gutter; these drains were laid at a depth of 2 feet 6 inches below the surface, and they discharge into the catch-basins.

The gutters were then excavated 6 inches below the subgrade of the roadway, and filled with screened gravel as a foundation for paying. The gutters are 2 feet wide, of

The gutters were then excavated 6 inches below the subgrade of the roadway, and filled with screened gravel as a foundation for paving. The gutters are 3 feet wide, of cobblestones which were picked out of the excavation. A stone foundation 0 inches in thickness was laid on the roadway. After breaking down all unevennesses of these stones they were covered with 3 inches of crushed stone from 2½ to 1½ inches in diameter, well rolled, and this was then covered with screened gravel or stone dust thoroughly watered and rolled to a hard surface. The walks are separated from the gutters by a border of loam walks are separated from the gutters by a border of loam 2 feet wide and 1½ feet deep. The walks have a fall of one-half inch to a foot, from the outer edge to the loam border. They are constructed of 6 inches of crushed stone, covered with stone dust well compacted by watering and rolling.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly anderstood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

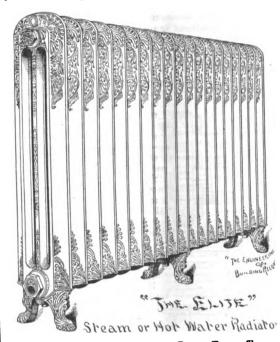
STEAM AND HOT-WATER RADIATOR.

THE accompanying cuts show a new cast-iron radiator that is about to be introduced by the A. A. Griffing Iron Co., of Jersey City, N. J., and to which they have given the name of the "Bundy Elite" to distinguish it from their other heaters.

The upper cut shows the radiator as it will appear when set up and in use, and the detail cut at the bottom shows a cross-section through the loops at half their height. It is a radiator without a base or entablature,

and is made up of a number of elements that are exactly alike in every respect. They are joined to each other at the lower end by ordinary 2-inch close taper nipples, and are not put together until they reach the positions they are to occupy. When used for steam the bottom nipple only is used, but when used for hot water an upper connection between sections is also provided.

They are made to meet that trade where a stock of radiators can be kept on hand and made up during the summer and used when required, without regard to fixed sizes, as any number of sections may be taken from stock and screwed together to make the length of radiator required to fit any place.





The legs are a separate part that will fit any section, as all are identically alike. They may be used on the outer sections or in threes, as shown in cut, or as taste may dictate, on the second or third sections from the end, so as to give an overhang. The legs are attached to the bottoms of the sections by ordinary tap-bolts, the bottom being thickened so the bolts will not go through. Eccentric bushings and plugs of similar ornamental design with the sections complete the radiator on the ends and prepare them for the steam connections, etc.

The principal feature of the Bundy "Elite" radiator section is its three tube loop-one centre one and two outside, the centre one being the shorter and the first to take steam; the course of circulation while filling being up in the centre and down through the outside tubes.

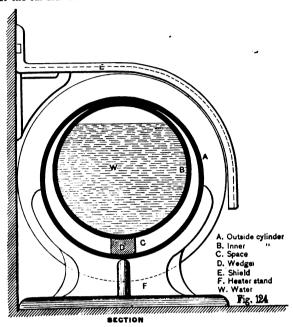
The sections are three inches from centre to centre in

the length of the radiator and eight inches wide, and contain about 51/2 square feet of surface each, when 36 inches high. At the heads of the sections there are slight projections on either sides that make a convenient lock to keep them in line when secured together.

NOTES ON WARMING RAILROAD CARS BY STEAM.*

BY WILLIAM J. BALDWIN.

DURING December, 1887, the writer was engaged in making experiments on the Long Island Railroad for the purpose of determining the probable amount of steam required for the warming of a train or car, and also to ascertain the length of time one of Gold's storage car-heaters would maintain the heat of a car after steam was shut off or the car side tracked and the becometing removed. or the car side-tracked and the locomotive removed.



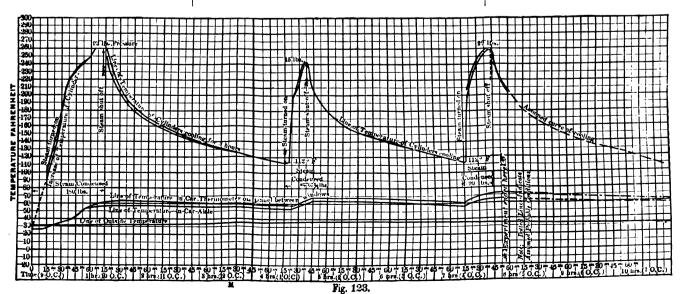
The better to record the experiments, a diagram was made of the day's observations, a copy of which is hereto appended (Fig. 123).

The line of figures at the bottom reading from left to right shows the time. The line of figures at the left reading upward shows the temperature in degrees Fahrenheit. The ordinates of the lower irregular line show the temperature of the air outside the car. The ordinates of the next two lines show the temperature maintained inside the car by two thermometers placed at different positions, and the ordinates of the upper two lines show the temperatures of the surface of the outside cylinders. The points at which steam was turned on and shut off are noted and the amount of steam, in pounds weight, condensed, as found by the

steam was turned on and shut off are noted and the amount of steam, in pounds weight, condensed, as found by the water condensed, is also shown.

Before going any further, however, explanation will be given in detail as to what the storage heater consists of. Fig. 124 shows it in cross section as applied to car 190 of the Long Island Railroad. A is a 5-inch diameter boiler tube of any required length (18 or 20 feet), with a cap on each end; B is a similar tube 4 ¼ inches in diameter with welded ends, seven-eighths filled with water and a solution of common salt; C is a steam-space between the outer and inner tubes; D is a block of iron to hold the inner cylinder against the internal top of the outer cylinder; E a shield and foot-guard, and F a cast-iron stand or leg fastened to floor of car.

* Paper read at the convention of the American Society of Mechanical Engineers at Nashville, Tenn., May, 1888.



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In reference to the measurements, capacity, etc., of the warming cylinders each .764 running foot has one square foot of heating surface; (2) one running foot of length of cylinder has 1.309 square feet of surface; (3) a running foot of the inside cylinder contains 7.303 pounds of water, when seven-eighths full; (4) one running foot of the inside cylinder and one running foot of the outside cylinder weigh together 13.4 pounds; and assuming that the water is put into the cylinders at 62° Fah., the iron of both cylinders has a storage capacity equal to 1.5247 pounds of water at 62°; and (5) a running foot of the heater (including cylinders and water) has a heat-storage capacity equal to 8.8277 pounds of water.

The manipulation and operation of the heaters is as follows: Steam is admitted to the space C the same as to any radiator. The heat of the steam is at once apparent in the car through the wall of the outer cylinder A, while at the same time it commences to heat the water in the inner cylinder. When the steam is on for a sufficient time, the water in the inner cylinder becomes practically as hot as the steam itself, and remains so until the supply of steam is cut off, when it begins to give off its heat by radiation, etc., to the walls of the outer cylinder.

The diagram shows the result in a manner more obvious than I can explain, and therefore I will only point to questions which may appear to require an explanation or to draw deductions

When steam was first turned on, it was unsatisfactory and low, the pressure being but ten pounds at the regulator. It gradually increased, however, to twenty-five pounds at the regulator and twenty-three pounds at the gauge within the car. At 10 A. M. the steam was shut off and remained so for three hours, or until 1 P. M. The whole steam condensed for this time (4½ hours) was 180 pounds weight, which was condensed between 8:45 and 10 A. M., or 42.35 pounds per hour.

or 42.35 pounds per hour.

During the first hour and a quarter the car was warmed from 27° Fah. to 61° Fah. After steam was shut off the temperature of the car advanced about one degree. Then its rate of cooling was about two degrees per hour.

its rate of cooling was about two degrees per hour.

At I P. M. steam was turned on again and kept on for twenty minutes. The condensation was 67½ pounds, and it restored the heat to the cylinders for three hours longer, or until 4 P. M., and sent the temperature of the car up to 69° Fah. This required less than twenty-three pounds weight of steam per hour to maintain the heat of the car for the time.

Steam was turned on again at 4 P. M. and kept on for thirty minutes. The condensation was then ninety pounds, and it is reasonable to assume it would have kept the car warm for four hours from the time of turning on. This is an average of thirty-three pounds of steam per hour for all day or say one horse-power per car per hour.

During the high temperatures on the outer cylinder, it is very likely the water is not as warm as shown, and during the process of cooling below 212° (or after condensation ceases), the inner cylinder must be the hotter. Of course, this is to be expected when steam is on for a short time only.

only.

The total heat of the steam and the total heat of the cylinders, assuming them to be seven-eighths filled with water, in the second stage of the diagram show this. Take for instance the total heat of the steam for the second stage of the diagram, and it is about 67,500 heat units. Then take the water or its equivalent for 78 feet lineal of cylinders and it is 688.5 lbs., apparently cooled from 243° Fah. to 112° Fah. or 131°, equal to 71,593 heat units (or apparently more than was in the steam). The heat of the iron connections, etc., is not taken into consideration, but if it was, it would only slightly increase the apparent gain and add to the apparent discrepancy.

gain and add to the apparent discrepancy.

The difference, however, is not so very great, but I consider it necessary to point it out, to prevent any misconception in the matter.

In the first stages of the diagrams where the steam has been on for an hour or so this is reversed, as should be expected, and somewhat more heat is found in the steam used than in the cylinders.

Take for instance the 180 lbs. of steam, condensed in the first stage of diagram. This is equivalent say to 180,000 heat units; as the water of condensation was somewhat cooled before the water in the inside cylinders heated. Then take 588.5 lbs. of water or its equivalent warmed from 27° Fah. to 260° Fah. and we have but 170,410 heat units.

The deductions to be drawn from the experiment in general are (1) that two square feet of surface per running foot of car is more than ample for warming; (2) that each square foot of surface requires heat equivalent to about 2 heat units for each degree the air is colder than the heater.

PLANT OF THE BOSTON HEATING COMPANY.

No. III.

(Continued from page 328.)

In actual steam practice it is found absolutely essential wherever there occurs any change in direction of the pipeline to introduce some means to provide for the expansion which is due to the variation between the temperature at which the pipe is laid and that which it attains as soon as circulation takes place. Experiments on various mechanical contrivances have convinced us that the best joint to be used for our purpose is the telescope expansion joint.

The expansion joint, Fig. 7, consists of a large casting having two longitudinal holes, into which the ends of the

supply and return mains are introduced. At one end of the casting these holes are supplied with threads E', and the ends of the pipes are screwed into them. By this means, as the expansion joint is firmly bolted to the masonry foundation, the joint forms an anchorage, so that one end of the section of pipe to which the joint is attached is firmly fixed and held in its place. At the opposite end of the joint from the screw threads the casting is enlarged so as to receive two sleeves of phospor-bronze, K, containing a large percentage of aluminum. These sleeves form the movable part of the joint, and, after being introduced into the casting, are carefully packed with a rope made of asbestos fiber, impregnated with black lead. This packing is introduced between the casting and the phosphor-bronze sleeve in the same manner as ordinary packing is introduced into stuffing-boxes; and the gland. E, is firmly fastened on top of the packing. The outside end of the phosphor-bronze sleeve is furnished with a screw thread, C, to which the end of the pipe is attached, so that when the pipe expands or contracts the phosphorbronze sleeve moves in and out of the casting and accommodates itself to the varying length of the pipe. By means of the gland in the stuffing-box and a ring, ϵ' , on the inside of the casting the phosphor-bronze sleeve is very carefully aligned, so that its motion in and out is in a straight line. In the joints which we have introduced here the sleeve of the supply main is long enough to give a motion of twelve inches, while that of the return main is about eight inches. Inasmuch as these joints are placed, on an average, as often as once in 100 or 150 feet, and the maximum motion for which they will have to provide is only from four to six inches, it will be seen that there is an abundant margin to prevent any possible cramping.

Last spring we built an experimental joint of this kind, and, setting it up in our shop in New York, put on a steam pressure of 450 pounds to the square inch, and, attaching a lever to the sleeve, worked the joint to and fro several thousan! times, corresponding to several thousand

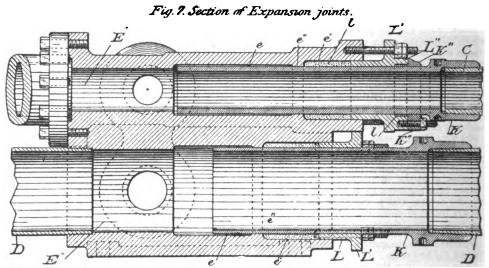
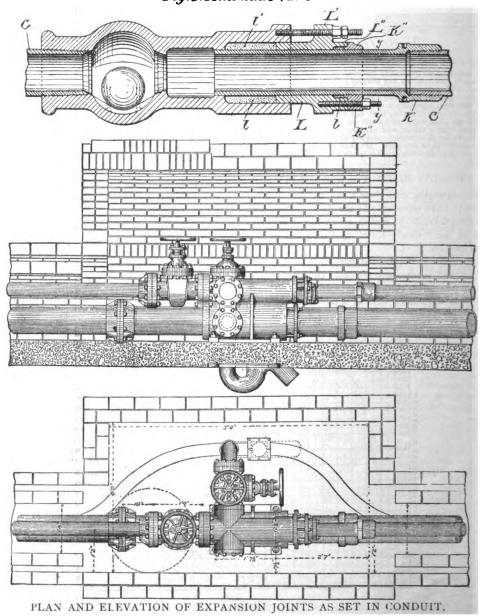


Fig. 8. Automatic Valve





expansions and contractions of the pipe. At the end the joint was as tight as it was in the beginning, not leaking

Each one of the expansion joints is placed in a manhole, so that it is perfectly accessible for inspection and repairs. On the fixed end of the expansion joint there is a valve, and in the casting of the expansion joint is a side outlet also provided with a valve. In the growth of the system it will soon be necessary to introduce cross pipes extending between the main supply-pipes passing through the side streets so as to give a hot-water supply to the intervening buildings. For example, there is a manhole at the corner of Devonshire and Franklin Streets and one at the corner of Franklin and Congress. At each of these manholes occurs an expansion joint. It is simply necessary to conneet the valve at Congress Street with the corresponding one at Devonshire Street, and then opening the valves a stream of hot water would flow between the two streets, making a cross connection from which the buildings on Franklin Street could be supplied.

When it becomes necessary to repack the expansion joints-though to the best of our belief the packing will last a long time-it is only necessary to shut off the valve at one manhole and a corresponding valve at the next to cut a section of the main out of the circuit; and, by opening a side valve, we can discharge the water contained in the main into the conduit which is provided with a drain for this purpose, and then, by blowing a stream of air into the manhole, cool it off sufficiently so that the workman can open the gland and introduce a new packing-all in the course of a tew hours. It could easily be done at night time when the demand for heat was a minimum.

Many questions have been asked as to the safety of this system; pertinent questions, too, because exaggerated statements have been current as to the pressure which we propose to carry.

The supply-pipe is made of what is called "extra heavy" pipe, the bursting strain of which is 12,000 pounds to the square inch, as we have ascertained by testing a number of samples to destruction. Every piece of pipe that has gone into the streets has been tested to 4,000 pounds to the square inch as a proof test. After the main is laid in place, every section-that is, the distance from one expansion joint to the next one-including all screw threads, all of the packing of the expansion joints, and all joints, has been tested to 1,500 pounds, and now that the main is completed we are, at the present time, making a test of the whole main up to 1,500 pounds from the station round back to the station again. So when the main is completed and ready for use it will have received, first, a test at the mill of 4,000 pounds; second, a test, by sections, of 1,500 pounds; and third, a test of the main, as a whole, of 1,500 pounds-all being pressures per square inch.

As an additional precaution we have, once in every section, a check-valve so arranged as to shut off automatically each section of the main in case of any accident. Malicious injuries might occur, for it is conceivable that in time of strikes men might dig up the main or drive a pick into it. The illustration, Fig. 8, is a section of this check-valve, shown in connection with an expansion joint. It will be seen that on the left-hand side of the joint the casting is enlarged so as to form a spherical cavity into which one end of the pipe, D, is screwed. The spherical cavity contains a ball, supported on two ribs so planned as to allow the ball, when at rest, to remain at the bottom of the cavity. The end of the pipe, C, is chamfered so as to form a valve seat. Under ordinary circumstances, the ball remains at rest on the ribs. The forces keeping the ball in equilibrium are its weight, acting downwards, and keeping it in place, and the friction of the water-current tending to force it up the inclined ribs and seat itself against either of the sides of the spherical cavity; so, by varying the weight of the ball, the valve can be adjusted so as to close with almost any desired velocity of current. Under maximum demands we can use a current of ten or fifteen feet a second, and the ball is so weighted as to close at a velocity of twenty feet a second. Should a rupture in the pipe occur, giving a velocity of twenty feet a second, the ball will leave its place, and, rushing up, close the end of the pipe and shut off the rest of the main. This is not simply theory, but is practice to the extent that we have made a number of these valves, and after experiment have found them to work very accurately.

Should any accident occur, either malicious or otnerwise, to rupture the main, it is obvious that only the

quantity of water contained between two check-valves should escape from such a break. As these valves are placed at intervals of about one hundred feet, the amount escaping would not exceed twenty cubic feet. The volume of the conduit is so large that should this entire quantity of water be discharged, the steam formed therefrom would be quickly dissipated through the length of the conduit without producing sufficient pressure to do anv damage.

The conditions which surround a pipe in the street are so different from those to which boilers are subjected, that a little consideration will show an explosion of the pipe to be an impossibility. A boiler, with its setting of masonry and bed of incandescent coal, is encompassed with a highly heated atmosphere, which constantly tends to supply it with more and more heat. The street pipe, on the other hand, is hotter than its surroundings. On the occurrence of a slight rupture or tear in the shell of a boiler, the pressure is relieved form the large mass of water therein contained, and an outflow of the boiler contents established through the incipient opening. The large diameter of the boiler-shell permits the molecules of water flowing toward the incipient rupture to attain, before reaching it, a very high velocity, while the hot masonry surroundings, and especially the glowing coals and incandescent gases of the furnace, furnish the water continuous supplies of heat, maintaining the pressure and accelerating the rushing molecules. So, in far less time than it has taken to describe this action, the current of steam and water has obtained such velocity that its impact has been sufficient to rend the boiler, and perhaps overthrowing the masonry, hurl it hundreds of feet from its original location. In the street pipe the comparatively small diameter precludes the possibility of a high velocity in the water-current even should an opening occur. Furthermore, as no supply of heat is furnished to the water, the pipe being surrounded by the comparatively cold conduit, every unit of steam formed abstracts and renders latent the heat from five units of water. Thus, even if a rupture occurred in the pipe no disastrous explosive action would follow, a simple tear through which the water would escape slowly into the conduit being the only result.

(To BE CONTINUED.)

PLUMBING IN THE CENTRAL TRUST COM-PANY'S BUILDING, NEW YORK CITY.

THE illustrated description of the plumbing work in the Central Trust Company's Building, New York, will be resumed in our next issue.

EXPLOSION OF A DOMESTIC HOT-WATER BOILER.

In our issue of Dec. 10 last we referred to an explosion of a domestic boiler in a hotel in Milwaukee which resulted in the loss of one life and injury to a number of persons, Every winter a number of these accidents have to be recorded, and every year we have pointed out in these columns the causes and the necessary safeguards to be adopted to prevent these disasters. The following account, which we take from the Locomotive, a little paper published by the Hartford Steam Boiler Inspection and Insurance Co., doubtless refers to the Milwaukee incident, although no name is given. At any rate, it explains the cause of water-back explosions when pipes are frozen, and points out the remedy so clearly that any plumber's apprentice ought to be able to understand it. We therefore reproduce it:

Explosions of domestic hot-water boilers attached to Explosions of domestic not-water boilers attached to cooking ranges, water-backs in ranges, etc., through freezing up of the pipes in cold weather, are becoming so frequent that it may not be out of place to give an account of one of the most destructive ones that has

account of one of the most destructive ones that has occurred recently, and point out its cause.

The boiler in question was used in a hotel in a large city in one of the Northwestern States, where the temperature is very low at times. It was connected to the kitchen range; the range was a large one, and the heating surface was furnished by a coil of 1½-inch pipe placed near the top, instead of the cast-iron front or back such as is commonly used in the smaller ranges in private dwellings. The connections to the boiler were made in the usual manner; the accompanying cut shows its essential

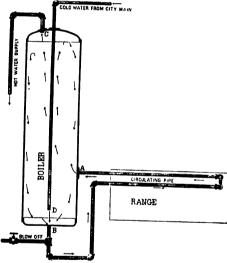
he operation of all boilers of this sort is as follows: The connections being made as shown in cut, the water is turned on from the main supply and the entire system is filled with water. When it is filled and all outlets are closed, it is evident that no more water can run in, although the boiler is in free connection with and is subjected to the full pressure of the source of supply.

a fire is started in the range, and the water in the circulating pipes or water-back is heated, the water expands, is consequently lighter, and flows out through the pipe into the boiler at A, as this connection is placed higher up than the one at B; this starts the circulation, and the water as it becomes heated constantly flows into the boiler at A and rises to the upper part of the boiler, while the at A, and rises to the upper part of the boiler, while the cooler water at the bottom of the boiler flows out into the cooler water at the bottom of the boiler flows out into the circulating pipes at B, and if no water is drawn a slow circulating goes on, as heat is radiated from the boiler, in the direction indicated by the arrows, the water at the top of the boiler always being much hotter than at the bottom. When the hot-water cock is opened, cold water instantly begins to flow into the boiler at D, by reason of the pressure on the city main and forces but water out of the pressure on the city main, and forces hot water out of the boiler at C. Thus it will be seen that hot water can-not be drawn unless the cold-water inlet is free, and it is equally evident that cold water cannot enter the boiler unless the hot-water cock or some other outlet is open.

unless the hot-water cock or some other outlet is open.

The above points being understood, we are in a position to investigate the cause of the explosion referred to, which killed one person and badly injured twelve or thirteen others, besides badly damaging the building.

On the morning of the explosion fire was started as usual in the range at 4 o'clock A. M. It was found on trying to draw water that none could be had from either cold or hot water pines: it was rightly indeed that the trying to draw water that none could be had from either cold or hot water pipes; it was rightly judged that the pipes were frozen. The fire was continued in the range, however, and the breakfast prepared as best it could be, and a plumber sent for to thaw out the pipes. He arrived on the premises about 7 o'clock, as would naturally be the case. He opened both hot and cold water cocks, and, acting neither steam nor water confuded these was and ease. The opened both not and cold water cours, and, getting neither steam nor water, concluded there was no danger, and proceeded to thaw out some pipes in the laundry department first. About an hour afterward the and the main portion of the boiler shot upward like a rocket through the four stories of the hotel and out through



The coroner held an inquest on the remains of the person killed, and some of the testimony given, as reported in a local paper, would be amusing were it not for the tragic nature of the affair which called it out. The usual rience, was there, and swore positively to statements which a ten-year-old boy who had been a week in the which a ten-year-old boy who had been a week in the business ought to be ashamed to make. He had examined the wreck with a view to solving the mystery (?) The matter was as much of a mystery now as on the day of the explosion. His theories were exploded as fast as he presented them. The boiler must have been empty. If it had been full of water it could not possibly have exploded, etc., etc. And then a lot more nonsense about the "peculiar" construction of the boiler. As a matter of fact, there was nothing peculiar about the boiler or its connections. Everything was precisely like all boilers of connections. Everything was precisely like all boilers of this class, of which there are probably hundreds of thousands in daily operation throughout the country, and moreover they were all right.

Now let us inquire what caused the explosion. Every-

Now let us inquire what caused the explosion. Everything was all right at 8 o'clock the previous evening, for water was drawn at that time. The fire was built in the range at 4 o'clock A. M. It is admitted that the coldwater supply pipes were frozen, for no water could be had for kitchen use. It is also proved absolutely that the hot-water supply was frozen or otherwise stopped up, by the fact that at 7 o'clock the plumber who came to thaw out the plumber who came to thaw out the plumber who came and got "neither the plumber opened the hot-water cook and got." The liber the pipes opened the hot-water cock and got "neither water nor steam." Here was his opportunity to prevent any trouble, but he let it pass. Any one who understood his business would have known that there must have been a tremendous pressure in the boiler at this time, as the range had been fired steadily for three hours; there were about eight square feet of heating surface exposed to the about eight square teet of nearing surface exposed to the fire by the circulating pipe in the range, and there had been no outlet for the great pressure which must have been generated during this three hours' firing. The blow-off cock should have been tried at one; if this were clear,

aitized by

and the probability is, from its proximity to the range, that it was clear, the pressure could have been relieved and the disaster averted. If the blow-off proved to be stopped up, then the fire should have been at once taken out of the range. At the time the plumber opened the cocks connecting with the boiler, it probably was under a press-ure of four or five hundred pounds per square inch. An ordinary cast-iron water-back, such as is used in small ranges in private houses, would have exploded shortly after the fire was built, but it will be noticed that the heating surface in this case was furnished by a coil of 1½ inch pipe; this was very strong, and the boiler was the first thing to give way, simply because it was the weakest

Accidents of this sort can be easily avoided by exercising a little intelligence and care. The hot-water cock should always be opened the first thing on entering the kitchen every cold morning. If the water flows freely, fire may then be started in the range without danger. If it does not flow freely, don't build a fire until it does.

Correspondence.

AN ADDRESS WANTED.

DEPOT QUARTERMASTER'S OFFICE, DAVID'S ISLAND, N. Y. H., April 19, 1888.

SIR: Please give me the address of the manufacturer of the dish-washing machine illustrated in your issue of March 31, 1888. I wrote to J. Haskins, Chicago, Ill., but the letter was returned. I wish to get particulars and price of the machine.
Yours truly,

GEORGE H. COOK. Capt. and Asst. Quartermaster, U. S. Army. [Referred to our readers.]

ON PROPRIETY OF OMITTING TRAP FROM HOUSE DRAIN CONNECTED WITH SMALL PIPE-SEWERS.

OFFICE OF CORNING WATER-WORKS, HEERMANS & LAWRENCE, PROP'S.
NO. 9 WEST MARKET STREET,
CORNING, NEW YORK, May 4, 1888.

SIR: The village of Corning last year constructed a system of sewers on the "separate" plan and house-connections are now being made therewith. The Sewer Commissioners, acting upon the advice of their engineer, have missioners, acting upon the advice of their engineer, have adopted rules and regulations for laying house-drains. They recommend that the vitrified pipe portion of the drain terminate within three feet of the cellar wall and iron pipe of diameter equal to that of the drain be extended full size, thence unobstructed through the cellar wall and to the roof. No trap to be used on the main drain, but all fixtures to be trapped and vented.

Is this the best practice? We have been regular readers of your paper since its first number and believe that your opinion in this matter will settle a question that good subbridies differ on.

authorities differ on. Yours, etc.,

HEERMANS & LAWRENCE. The omission of the trap on the main drain is one of the features of the system patented by Col. Geo. E. Waring, and put in by him at Memphis, the house soil-pipe being relied on for ventilation of the sewers. The propriety of omitting the main trap from a house-drain we have always considered depended on the maintenance and condition of the sewers and soundness of the work within the houses. When that cannot be depended on to be in ideal condition. we have preferred the obstruction of the trap on the main drain, with, of course, the fresh-air inlet, as the lesser evil. You do not give us all the details of your sewer system, as to number of manholes, distance apart, means of flushing, etc., consequently we cannot give a definite answer on your particular problem. As a general proposition, we think the local authorities should provide sewer ventilation independent of the co-operation of householders.]

EFFECT OF GALVANIZED IRON PIPE ON

ASHTABULA, O., April 30, 1888.

SIR: Please will you reply at once and state to me if there is any poison or bad effects apt to cause trouble from the use of galvanized pipe? Is the black iron pipe any better for family use than the galvanized? P. E. HALL, JR. Yours respectfully,

[With ordinarily pure water there is no danger to health in the use of cisterns or pipes of galvanized iron. All drinking-water will dissolve zinc from the interior of galvanized pipes, but under no circumstances will enough of the salts of the metal be dissolved to exercise any harmful effects on the human body without making the water so milky and giving it such a strong metallic taste that no one would use it.]

GENERAL GEORGE S. GREENE. 125 WILLOW STREET,

MINNEAPOLIS, Minn., May 7, 1888.

SIR: Could you without much trouble give the address of Gen. Geo. S. Greene? I notice his name frequently in

connection with A. S. C. Engineers. He must be a very old man. I was his rodman in 1836 on what is now the Boston and Maine Railroad, Mass., in its earliest history. Judging from my own age (which is seventy), he must in the vicinity of eighty-five or ninety. I would like I would like to communicate with him.

Very truly yours

GEO. T. CLARK.

[We do not know Gen. Geo. S. Greene's age, but he is as active as a man of fifty. His address is 38 Union Square (East), New York.

A PROBLEM IN SANITARY ENGINEERING.

STAUNTON, VA., April 26, 1888.

SIR: We have a creek running through our city into which our sewers empty, and as there is not enough water to keep the creek clean we are thinking of putting in auto-matic flood-gates. Will you kindly inform me whom to write to for information or refer me to any work on the subject?

C. BARGAMIN.

[An open sewer in a thickly-settled district is an abomination that should not be tolerated at all. That is what you have made of your creek, and no number of automatic flushing contrivances can do more than mitigate the nuisance; they cannot remove it.

We are glad, however, to see that you appreciate the importance of seeking some further information as to what should be done, and you will find in our advertising columns, under the heading "Professional," the cards of a number of competent sanitary engineers, to whom you can confidently apply for such advice as you may need.]

HYDRAULIC RAMS.

ARK. IND. UNIVERSITY. FAYETTEVILLE, ARK., May 2, 1888.

SIR: I am a Senior civil engineering student of this university, and am at present studying up the subject of "hydraulic rams." If you could give me any information on it, such as references, etc., I shall be grateful to you.

Very respectfully, George C. Schoff.

[An elementary description of the hydraulic ram was given in a lecture before the plumbing class of the New York Trade School, published in our issue of April 21.

The handbooks of Trautwine, Molesworth and Nystrom each give some space to it, and Ewbank's Hydraulics has several pages on the subject. Doubtless the manufacturers of hydraulic rams would be glad to furnish you all the information you desire.]

COLONEL R. T. AUCHMUTY'S OFFER TO DO-NATE \$9,000 TOWARDS THE ESTAB. LISHMENT OF A PHILADELPHIA TRADE SCHOOL.

(From our Correspondent.)

PHILADELPHIA, May 9, 1888.

THE Master Builders' Exchange of Philadelphia, at a special meeting on May 8, agreed to establish a trade school in the city of Philadelphia under the auspices of the Exchange, which will be modeled after the New York

The inception of the project was a letter received in The inception of the project was a letter received in this city, and read at the meeting of the Board of Directors of the Exchange some few weeks ago, from Col. Richard T. Auchmuty, of the New York Trade School, in which he offered, if a school was started in Philadelphia under the auspices of the Exchange, to contribute the sum of three thousand dollars per annum for three years towards the support of the school.

The letter was referred to a special committee to visit New York and have an interview with Colonal Auchman.

The letter was referred to a special committee to visit New York and have an interview with Colonel Auchmuty on the subject, and to examine the workings of the New York school. The Committee of Eleven, of the most prominent men in the Exchange, representing nearly all the trades in the building fraternity, went to New York on April 26, visited the school, had an interview with Colonel Auchmuty, and came back highly pleased with what they saw and heard, and, as a result, agreed to recommend to the Exchange the acceptance of Colonel Auchmuty's offer, and that a committee be appointed to Auchmuty's offer, and that a committee be appointed to make a move towards the consummation of the project.

In accordance, at a special meeting of the Exchange on May 8, Mr. William Harkness reported the visit to New York, and, after discussion, Mr. John J. Weaver offered

the following preamble and resolutions:
"Whereas, If we desire skilled American journeymen in the future we must instruct the boys of to-day, and as the apprentice system, especially in large cities, is practically obsolete, and, from the good results already shown, we welcome the mechanical trade school as its worthy successor; and
"Whereas, Col. Richard T. Auchmuty, the founder of

the New York Trade Schools, has generously offered to contribute the sum of \$3,000 per year for three years toward the support of a mechanical trade school in this city, if under the auspices of this Master Builders' Ex-

change, therefore be it

"Resolved, First.—That the very generous offer of Col.
Auchmuty is hereby accepted with thanks.

" Second,-That a mechanical Trade School Committee of three members of the Exchange be appointed from each of the following trades: Bricklaying, carpentry, stone cutting, blacksmithing, painting, plastering, plumbing, and such other trades connected with building as necessity may arise, for the purpose of establishing a school in which instruction shall be given in each of the above-named trades.

' Third.—That a subscription list be started at once, and not only the various trades, but citizens generally who may wish to aid in this good work of enabling the boys to secure a trade and thus earn an honest living with their hands, are hereby invited to contribute to a fund for the establishment of this the Builders' Exchange Mechanical

Trade School.

"Fourth.—That the Treasurer is hereby authorized to receive contributions for the above fund and instructed to

open a separate account for the same."

The resolutions were adopted and the committee will shortly be announced.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company. Fquitable Gast-Light Company
May 5	25.74	20.71	23.44	30.27	29 85	26.00 32.22

ARCHITECTURAL LEAGUE OF NEW YORK.

THE regular reunion and dinner of the League was held 1 HE regular reunion and dinner of the League was held at Morello's on the 7th inst., when a paper on "Errors in Construction," given elsewhere in this issue, was read by Mr. A. F. D'Oench. There was also an exhibition of the architectural efforts of the pupils of the technical classes of the Metropolitan Museum of Art, the School of Mines. Columbia College, and the architectural department of Cornell University.

Johnstone Norman, Esq., of England, showed the design of Alma Tadema, R. A., for the piano and other furniture for the music-room of Henry G. Marquand's

New York residence.

The resignation of Mr. Charles I. Berg, who had been the secretary of the League from its formation in 1881, was regretfully accepted.

The following resolution was unanimously adopted:
"The members of the Architectural League learn with
regret of the resignation of their esteemed Secretary, Mr. Charles I. Berg, and desire to express their appreciation of his long and faithful services, which have continued without interruption since its formation in 1881, and that they heartily and unanimously extend to him their sincere thanks for the very able and conscientious discharge of his arduous duties, which have been of inestimable value to this organization."

Mr. W. C. Hazlett, from the Committee on Medal

Mr. W. C. Hazlett, from the Committee on Medal Design, reported the acceptance of the design submitted by Mr. Blashfield.

The following members were elected to the League, which now numbers 152 practitioners.

Residents: C. L. W. Eidlitz, Maurice Fornachon, Hughson Hawley, E. A. Sargent, A. P. Ryder, W. A. Coffin, Thomas Hastings, E. B. Rutledge, C. D. Marvin, G. L. Hines, Alvan C. Nye, Julius Harder, Robert W. Gibson. Non-residents: Prof. Charles Francis Osborne, Cornell University; James G. Cutter, Rochester, N. Y.; Ed. I. Nickerson, Providence, R. I.; William Whitney Lewis, Boston; Leoni W. Robinson, New Haven, Conn.

AMERICAN SOCIETY OF MECHANICAL EN-GINEERS.

THIS society held its annual convention in Nashville. Tenn., commencing on the 8th inst.

Tenn., commencing on the 8th inst.

The programme as announced promised much pleasure and profit to those who attended, and we expect in our next issue to give a report of the proceedings from our representative. One of the papers read appears elsewhere in this issue.

PERSONAL.

STEVENSON TOWLE, Mem. Am. Soc. C. E., has been appointed Park Commissioner of New York.

MR. COLEMAN SELLERS, mechanical engineer, of Philadelphia, has been appointed to the new Chair of Engineering Practice at the Stevens Institute of Technology.

THE Humane Society of the Commonwealth of Massachusetts has selected the design of Mr. Frank E. Wallis, an architect of New York, for a large solid silver memorial

DR, GEORGE F, SHRADY, Editor of the Medical Record. has been confirmed by the New York State Senate as successor to the late Dr. C. R. Agnew in the Board of Trustees of the Hudson River Hospital for the Insane.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

WE have received the new catalogue of the Pond Engineering Co., of 707-709 Market Street, St. Louis, Mo., illustrating their steam and hydraulic machinery and specialties for steam users. The catalogue contains a con-siderable amount of data on steam and hy-draulic engineering, and will be sent free to interested parties on application.

TO WATER-WORKS ENGINEERS.

TO WATER-WORKS ENGINEERS.

The King of the Belgians has instituted an international competition in which a purse of 25,000 francs is to be given for the best essay on the most economical method of piocuring for large cities, and especially Brussels and its suburbs, an abundance of the best quality of potable water, due provision being made for the national increase of population.

Essays may be either printed or in manuscript.

A new addition of a published work will be considered only as to additions and improvements that may have been made in other works during the period of competition—thatis in, the years 1889, 1890, 1891 or 1892.

The works may be written in French, Flemish, English, German, Italian or Spanish. Foreigners who desire to compete for the prize must send their essays by January 1, 1893, to the Minister of Agriculture, Industry and Public Works, at Brussels.

The work that receives the prize will be published during the following year.

The judgment as to the competing works shall rest with a jury of seven members, three of whom shall be Belgians, and the other four foreigners from different nationalities to be nominated by the King.

ARCHITECTURAL COMPETITIONS.

BRIDGETON, PA.—Church.—Plans are wanted for a church edifice to be erected here by the Fourth Methodist Episcopal Church. No date specified. The committee on plans consists of Corstant Albertson, Eli Loper and George W. McCowan.

DETROIT, MICH.—Church.—Plans are wanted for a \$35,000 church edifice, to be in the Romanesque style of architecture. No date specified. Address: Rev. Mr. Hamilton, No. 1106, Woodward Avenue, as above.



orks for which proposals are requested see also e "Proposal Column," pages i-vii-viii-344

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

CRESTON, IOWA.—Water.—A system of water-works to be constructed here at an estimated cost of \$80,
50. For particulars address Mr. Rudegar.

Oco. For particulars address Mr. Rudegar.

Newark, N. J.—Water.—The Water Commissioners have recommended that proposals be solicited for an additional pump at the Clifton Avenue house, an additional boiler at Belleville, an extension to the boiler house there, and an extension to the engine room at Clifton Avenue. The pump desired at Clifton Avenue is a 5,000,000 gallon one for the High Service system. The Mechanical and Civil Engineers of the Board have been instructed to formulate plans and specifications for the new pump, and after they have been accepted by the Executive Committee bids will be advertised for. Bids for the supply of water at Belleville are also soon to be advertised for. Commissioner Wismer can furnish details.

See our Proposal Column on page 344 for advertisement for bids on the pumping engine.

Newark, Del.—Water.—The town council of this

NEWARK, DBL.—Water.—The town council of this place have appointed May 19 for an election to be held for or against a system of water-supply and sewerage, the proposed system to cost \$25,000. A public meeting is to be held on the evening preceding the election, when the system of water-supply will be explained by expert engineers. It is thought that the measure will carry.

CHADRON, NEB.—Water.—Our correspondent writes:
"A. A. Richardson, C. E., of Lincoln, Neb., is preparing plans and specifications for a system of waterworks to be constructed here at a cost of \$40,000." Address him for details.

FREEHOLD, N. J.—Water.—Concerning the report that the water-works question was to be settled at a public election, James S. Yard, Chief Commissioner, writes us as follows, under date of May 8: "The matter has been under discussion some time. At the annual charter election held yesterday, a resolution directing the Board of Town Commissioners to submit the question, according to law, to a vote of the people at a special election, failed to obtain a majority of the votes cast."

SYLACAUGA, ALA.—Water.—Regarding the water-works project here, J. K. Lanning, Eq., city editor of the Argus, writes as follows: "There has been a good deal of talk about water-works, but nothing has been done as yet."

LEOTI, KAN.—Water.—It is reported that a \$15,000 system of water-works is to be established here.

Winchester, Ky. — Water. — Our correspondent writes: "No steps have been taken so far to enter into any contract for water-works. A committee has been appointed, but has not reported as yet. That the town will have water-works is a certainty but, the plan to be adopted has not yet been decided on. We have two plans offered: one to bring water from the Kentucky, the other to build artificial lake, and don't know what plan will be adopted."

MARION, ALA.—Water.—Concerning the report that water-works were to be erected here, Mayor J. A. Moore writes as follows: "Nothing definite; only a newspaper agitation so far, and no individual or well-directed effort."

GADSDEN, ALA.—Sewers.—Our correspondent writes:
"This city will establish a system of sewerage. Maps, plans and specifications will be ready before long. Bonds will be issued to cover cost, perhaps \$50.000." For complete details address John H. Disque, Attorney at Law, as above.

LANSINGBURG, N. Y.—Water.—It is reported that the taxpayers of this place will decide the question of building a \$25,000 storage reservoir, at the polls on May 22.

RED BLUFF, CAL. - Water. — The Antelope Creek and Red Bluff Water Company has been incorporated here, with a capital of \$200,000. Peter Deekee can furnish details.

Wichita, Kan.—Water.—The Fairmount Water Company has been organized here, with a capital stock of \$50,000. George C. Strong and others are interested.

BIRMINGHAM, ALABAMA. — Water. — The stock-holders of the Elyton Land Company have authorized the directors to begin work at once on an aqueduct to supply the city with water from the Cohaba River.

OSTEGO, MICH.—Water.—It is reported that a water-works company is to be established here.

ST. PETER, MINN.—Water.—It is reported that the question of appropriating the sum of \$32,000 for a system of water-works is to be settled at a special election to be held soon.

tion to be held soon.

ABINGTON, MASS.—Water.—Regarding the report that extensions were to be made to the water-works system here, J. W. Synod. the Town Clerk, writes us as follows: "The works contemplated, extension of about four miles, have been contracted for, and the men are now at work and have been for a month. There is no new extension that I am aware of."

WATER-WORKS.—See our Proposal Column for information regarding water-works and water-works supplies at the following places: New Brunswick, N. J., David's Island, N. Y., Milwaukee, Wis, Newark, N. J.

BRIDGES.

REPUBLIC, MICH.—It is reported that the bridge over the Michigamme River, near this place, on the line of the Milwaukee and Northern Railroad, has been totally destroyed by the floods. The dispatches say that high water undermined the structure, causing its destruc-tion.

WELLINGTON, KAN.—The County Commissioners have decided to erect five iron bridges at different points near this place. The contracts will be advertised as soon as specifications can be prepared. For details address George Camp, Chairman of the Board.

CANFIELD, MINN.—An iron bridge is to be erected here. For details address the County Commissioners.

KASSON, MINN.—The County Commissioners will rect two bridges at this place.

MANTORVILLE, MINN.—A bridge is to be erected here. For details address the County Commissioners.

JAMESTOWN, N. Y.—Press dispatches state that a \$75,000 bridge belonging to the Eric Railway at this place has been destroyed by fire.

piace has been destroyed by fire.

Montreal, Canada.—Henri Malingre, architect, has forwarded to the Railway Commission at Ottawa the plans he had been requested to prepare by the Town Council of Longueuil for the proposed bridge across the river opposite the city. If a favorable opinion is received from the Commission a joint stock company will be formed for the construction of the bridge. According to the plans, the structure will cost \$2,000,000. It will begin on this side of the river at Point St. Charles, and, with a gradual descent, will span the main channel sixty feet above the low-water level, and, with a gradual descent, will cross St. Helen's Island, ending on the Government Common on the south shore above the town of Longueuil. It will be constructed of iron. Upon it will pass the cars of the South Shore lines, street-railway cars, vehicles, and persons on foot.

Wauwatosa, Wis.—The Board of Supervisors of

WAUWATOSA, WIS.—The Board of Supervisors of Milwaukee County will erect a bridge across the Menomonee River in the town of Wauwatosa.

BRIDGES.—See our Proposal Columns for informa-on regarding bridge construction at Cuming Co., Neb.

BARTON, N. Y.—It is reported that the Highway commissioners of this place will erect an iron bridge at

GAS AND ELECTRIC-LIGHTING.

DOVER, N. J.-This place is to be lighted with electricity.

tricity.

MILWAUKEE, WIS.—The Milwaukee Gas Light Co. has made a proposition to renew its contract with the city, which expires July 1, at \$23.00 per lamp instead of \$30.00. This will save the city \$16,000 per year. The matter is in the hands of the Gas Committee.

RAILROADS, CANALS, ETC.

PATCHOGUE, L. I.—The project of building a street railroad here is being agitated, and a petition asking the Legislature to grant the Patchogue Ranway Company a franchise has already been sent to Albany. It is not as yet decided whether horses or electricity will be used. The Town Clerk can furnish details.

DAVENPORT, IOWA.—An electric railroad is to be built here as soon as preliminaries can be arranged.

MINNEAPOLIS, MINN.—Application has been made for a franchise for the Enos Electric Elevated Railway to run to St. Paul as well as in this city.

MILWAUKEB, Wis.—The Whitefish Bay Dummy Line, of this city, will run a street car line on North Street from the lake to the western city limits, about three mules.

BLACK RIVER FALLS, WIS.—The Chicago, Milwau-kee and St. Paul RR.Co. will build an extension from Black River Falls to Sperbeck, Wis.

ST. PAUL, MINN.—Another scheme is on foot to build an elevated railway between this city and Minneapolis. The capital stock is \$2,000,000. A. H. Wilder, Wm. Dawson, Jr., St. Paul, are leading incorporators.

BIDS OPENED.

BIDS OPENED.

Denver, Col.—Capitol Building.—The following bids for the completion of the State Capitol Building at this place were opened May 1 by the Board of State Capitol Managers.

For the entire structure complete: J. A. Moross & Son, \$1,213,225; The E. F. Hallack Company, \$1,278,885; Gumry, \$1,452,000.

For cast and wrought iron work, including vault work: P. E. Lane, Chicago, \$517,442; Colorado Iron Works, Denver, \$267,442; Clark & Co., \$281,632.

For all stone and brick work for a finished and complete job: Geddis & Seerie, Denver, \$679,000.

For all brick work required; R. P. McDonald, \$118,-956; Benjamin Brenn, \$184,475; C. Y. Smith and Ashland, \$146,968.

For plastering, plan and ornamental stucco work:

fand, \$146,968.

For plastering, plain and ornamental stucco work:
M. D. Currigan, \$68,785; Charles McCabe, \$72,898;
C. W. Lawrence, \$79,885.

For painting, glazing and glass: J. B. Sullivan & Broa., Chicago, \$42,744.

For painting and graining: Charles L. Dow, \$14,-

For painting and graining: chances 2. 2007, vol.

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For all plumbing, sewerage and gas-fitting: C. J.
Reilly, \$13,747; E. H. Cook Co., of Rochester, \$39,750;
Suess Brothers, \$22,500.

For steam work, plumbing, sewerage and gas-fitting:
Samuel I. Pope & Co., Chicago, \$40,994.

For marble steps, tiles, etc.: Pickel Marble Co.,
Chicago, \$36,165. (The amount of \$6,335 will be deducted from their bid if encaustic tile is used in place of marble.)

For galvanized iron work, copper work, zinc work

of marble.)
For galvanized iron work, copper work, zinc work and corrugated work: James J. Walter, \$64,000; another bid, \$83,938.
For vault doors: Hall Safe and Lock Co, \$4,600; George H. Bushnell & Co., \$1,474.
Miscellaneous: Two hydraulic elevators, \$9,900; steel covering of dome. \$10,386; statuary, Ed. P. Gau-phin. \$2,000.

phin, \$7,000.

The bids have all been turned over to Mr. Meyer, the architect of the building, for his investigation.

PHILADELPHIA, PA.—Schools.—The following proposals for erecting school buildings were opened May 4, by the Board of Education: School-house at 8th and Wo.f. Sts., 1st Section, Chas. McCaul, \$58,480, and C. O'Neil, \$57,591. School-house at Richmond and Jenks Sts., Bridesburg, Chas. McCaul, \$58,000, J. Wenzelberger, \$63,480. School at 16th and Moore Sts., the bidders for the different sizes of schools proposed, they being of 15, 18 and 21 division capacity, were James Bradley, \$58,000, \$64,050 and \$70, too; Charles McCaul, \$56,800, \$62,300, \$67,800; C. U'Neil, \$55,991 and \$62,639, for the two smaller. School at 13th and Tremont, S. H. Jordan, \$71,773; Chas. McCaul, \$61,514.

ALLEGHENY, PA.—Pumping-Engines.—The following bids for furnishing two horizontal plunger pumping-engines, outside packet, each with a capacity of delivering 5,000,000 gallons of water 250 feet high, with a piston speed not exceeding 100 feet per minute, the same to be without foundations, were opened May

2 by Comptroller James Brown: Wilson Snyder Manufacturing Co., Pittsburg, Pa., two bids, \$45,000 and \$42,000; George F. Blake Manufacturing Co., New York City, two bids, \$43,450 and \$54,600; Holly Manufacturing Co., Lockport, N. Y., two bids, \$38,000 and \$36,000; Henry R. Worthington, New York, \$50,000 and \$42,000; Gordon & Maxwell Co., Hamilton, O., \$40,000. All the proposals were referred to the sub-committee.

ALLEGHENY, PA.—Stop-Gates.—The following proposals for furnishing a quantity of stop-gates were opened May 2 by James Brown, Comptroller: Union Foundry, Allegheny, Pa., 4-inch, each, \$7.80; 6-inch, 12.35; 16-inch, \$60; J. R. Richardson, Allegheny, Pa., \$10, \$14, \$08; Kelly & Jones Co. Pittsburg, Pa., \$8, \$12.25; \$72; Bailey, Farrell & Co., Pittsburg, Pa., \$8.40, \$13.50, \$60; Atwood & McCaffrey, Pittsburg, Pa., \$8.65, \$13.47, \$74.93.

STAMFORD, CONN.—Bridge.—The Berlin Iron Bridge Company, of East Berlin, have been awarded a contract to construct, etc., an iron bridge over Mill River, at this place, at a cost of \$10,627.

at this place, at a cost of \$10,027.

New York City.—The following bids for electric street lighting for the city, for the year beginning May 1, 1888, were opened May 9, by the Gas Commission: The Brush and United States companies, 441 lights each, at 35 cents a night; East River Company, 493 lights, at 35 cents; Mount Morris Company, 361 lights, from 17½ cents to 40 cents, according to locality. The North New York Company, 228 lights, at 35 cents; the Ball Company, 499 lights, from 26 cents; Harlem Lighting Company, 459 lights, from 26 cents to 60 cents. The bids were referred to Secretary McCormack for tabulation.

tabulation.

Contracts were awarded to six of the gas companies for street lighting, as follows: Equitable, \$12 a year for each lamp; New York Mutual and Consolidated, \$17.50; Central (in Twenty-third Ward), \$28; Northern and Yonkers (in Twenty-fourth Ward), \$29;

ern and Yonkers (in Twenty-fourth Ward), \$29.

Boston, Mass.—Stony Brook Improvement.—The Superintendent of Sewers has received proposals for building Set tion 4 of the Stony Brook sewer. The specifications called for 12,300 cubic yards earth excavation, 200 cubic yards rock excavation, 450 yards concrete, 900 cubic yards rubble stone, 1,900 cubic yards brick masonry, 50 yards brick masonry in Portland cement, five cubic yards dimension stone, 100,000 feet B.M. lumber and 1,406 spruce piles. William Whattaker bid 80c., 30c., \$4.75, \$5.50, \$12.50, \$21.50, \$21.450, \$40, \$25, \$3-total, \$48,365.50. Thomas A. Rowe, 70c., \$1, \$5, \$5, \$5, \$13, \$14, \$30, \$25, \$2.25-total, \$47,48. Solomon Sanborn, 80c., \$1, \$4, \$0, \$6, \$14, \$15, \$20, \$26, \$3-total, \$51,517. A. Saucier, 75c., 25c., \$6, \$5.40, \$13, \$15, \$25, \$26.40, \$3-total, \$49,331. Charles Linnehan, 90c., \$3, \$4.60, \$4.60, \$12.75, \$14, \$15, \$23, \$2.35, \$2.10, \$11.85, \$23, \$24.50, \$3.44.50, \$3.24.50, \$3.50-total, \$49,777.50. Awarded to Mr. Cram.

EAST LIVERPOOL, O.—Sewers.—The following pro-

50c., \$4.50, \$5.10, \$11.85, \$12.85, \$23, \$24, \$24, \$0, \$3.50—total, \$47,177.50. Awarded to Mr. Cram.

EAST LIVERPOOL, O.—Sewers.—The following proposals for constructing sewers at this place were opened April 24 by the Board of Sewer Commissioners: Frank Riley and James F. Kuntz, Cleveland, U., \$23,920; Thomas Connell, Youngstown, O., \$24,030; Coon & Co., Washington, Pa., \$30,520.50; W. M. Chisholm, East Liverpool, O., \$28,155; J C Murray, Newark, U., \$49,400; Allen & Franklin, Buffalo, N. Y., \$35,069.38; J. J. Everson & James Christie, Jr., Akron, U., \$30,030,50; H. C. Howard & Co., Pittsburg, Pa., \$64,773.50; T. C. Brooks & Co., Detroit, Mich., \$41,309.50; C. H. Vonte, Toledo, O., \$33,007. Richard Dickson, Sault Ste. Marie, Mich., \$38,199. The bid of J. C. Murray was not considered.

The following contracts were awarded: Construction, Thomas Connell, Youngstown, O.; sewer pipe and specials, Knowles, Taylor & Anderson, East Liverpool, at 55 per cent. off list, delivered on line of trenches; cast-iron pipe and specials, Andrew J. Boyce, East Liverpool, \$20.70 per ton, specials 2% cents per pound; Portland cement, Miller & Sons,

SUMMARY OF BIDS FOR SECTION 16, NEW CROTON AQUEDUCT. Opened by the Aqueduct Commissioners, May 9.

Engineer's Estimate.	Quantities and Items.	O'Brien & Clark.	Wm. E. Dean.	Miles Tierney.	Mathew Baird.	W.S.Cole- man & Co.
Engi Esti		Amoutt.	Amount.	Amount.	Amount.	Amount.
906.000	120,000 cubic yards earth excavation	\$36,000	\$30,000.00	\$84,000	\$30,000	\$10,000
#30,000	60,000 cubic yards rock excavation	87,000	100,500.00	90,000	90,000	165,000
120,000	160,000 cubic yards refilling and embankment	40,000		16,000	48,000	32,000
50,000	1,500 cubic yards brick masonry	15,000	22,500.00	18.000	18,000	18.000
6,000	1,200 cubic yards concrete masonry, 5 to 1	6,000		6,000	6,000	6.000
	300 cubic yards concrete masonry, 3 to 1	1.800	1,425.00	t 800	1,800	1,800
1,500	500 cubic yards cubble-stone masonry	3 000	1,750.00	2,000	2,500	2,500
2,500	1,000 cubic yards dry rubble stone masonry	3,000		3,000	3,000	4,000
4,000	50 cubic yards dimension-stone masonry	2,500	1,850.00	2,000	1,250	3,250
2,500	25,000 square yards Telford McAdam pavement,	_,,,	, ,	· '	, ,	.,,-3-
31,250	taken up and relaid	25,000	30,000.00	25,000	31,250	37.500
6.000	4,000 square yards block pavement to be taken	,	• •			3, 3
0,000	up and relaid in connection with Telford-Mc-					
	Adam pavement	2,000	2,400.00	2,000	2,400	5,000
7 500	6,000 square yards stone block pavement to be		.,	1		
/,300	taken up and relaid	3,600	3,000.00	3,000	3,600	7,500
747.000	24,700 tons cast-iron straight pipe	617.500		617,500	623,675	623,675
48,000	800 tons special castings	43.200	48,000.00	43,200	44,600	41,600
500	5 tons wrought-iron work	500	475.00	750	500	50>
8 000	4 48-inch stop-cocks (each)	6,000	10,800.00		8,8co	8,000
700	14 12-inch stop-cocks "	1,400	658.00	1,400	630	5,600
200	8 6-inch stop-cocks "	490	168.00	400	200	800
180	12 blow offs (each)	600	180.00	600	240	1,200
250	s hydrants "	350	350.00	250	350	500
175,000	Laying 70,000 lin. feet 48-inch cast-iron pipe	110,000	77,000.00	120,000	105,000	140,000
625	Laving soo lin. feet 20-inch cast-from pipe	375	225.00	500	350	500
1.200	Laying 2,000 lin. feet 12-inch cast-iron pipe	800	600.00	1,000	1,000	1,500
175	Laying 500 lin. feet 6-inch cast-iron pipe	200	150.00	125	150	250
66	200 lin. feet 6-inch stoneware sewer pipe	100	200.00	100	50	120
78o	300 lin. feet 10-inch stoneware sewer pipe	210	375.00	210	180	240
350	soo lin, feet 12-inch stoneware sewer pipe	500	1,000.00	400	300	
1.875	r. soo lin. feet re-inch stoneware sewer pipe	2,550	3,750.00	1,500	1 300	
10.800	360,000 feet B. M. hemlock timber	7,200	7,920.00	7,200	8,640	10 800
- 1,000	7.5					
	Total bid on work complete	1,030,215	1,053,232.25	1.009,545	1,040,475	1,155.205

Diaitized by

Warners, N. Y., \$2 per barrel at the works; brick, W. S. Smith & Co., East Liverpool, \$8 per 1,000 delivered on the line of the trench.

NEW YORK CITY—Wooden Pier.—The following proposals for building a woopen pier, with approach and appurtenances, including a sewer-box on the site of said pier, to be known as Pier New 36, East River, were opened May 10 by the Department of Public Docks: Joseph B. Sanford, \$28,911.25; Ranuld Gillies, \$20,871.25. The contract was awarded to Joseph B. Sanford.

ST. PAUL, MINN.—The Board of Public Works has awarded the contract for paving Kent Street with asphalt to the Warren-Scharf Asphalt Co. for \$10,055.

GODERICH, ONT.—Water-Works.—The following proposals for the construction of a system of waterworks were opened May 1 by William Campbell, Town Clerk:

Leathorn.
Two Boilers—14 feet long, 62 inches in diameter.
John Corrie & Co., \$2,700, feed-pump included; Polson Iron-Works, \$2,050, no feed-pump; Chrystal & Black, \$2,80, feed-pump included. Contract awarded to Chrystal & Black.
The bids for pumping-engine were held over.

GOVERNMENT WORK.

David's Island, N. Y. H.—Plumbing.—All proposals for plumbing work in the brick barrack at this place have been rejected by action of the Quartermaster-General and new proposals are to be advertised for.

for.

New York City.—River Improvement.—Abstract of proposals for turnishing the following named articles for use in the Harlem River improvement, opened May 3, by G. L. Gillespie, Lieut-Colonel of Engineers: 40,000 feet spruce or hemlock timber, per linear foot. George Karr & Co., New York City, 6 cents; E. L. Richardson, New York City, 5% cents; James Du. Bois, New York City, 6% cents; James Du Bois, New York City, 6% cents; James Du Bois, New York City, 6% cents; James Du Bois, New York City, 6% cents; James Du Bois, New York City, 6% cents; James Du Leary, 5% cents; James Du Bois 6% cents; James Du Leary, 5% cents; James Du Bois 6% cents. 8,000 feet, B. M., of roxro inch, square, yellow pine timber, per M. feet: George Karr & Co., \$24; E. L. Richardson, \$25; James Du Bois, \$25. 20,000 lbs. %x16-inch drift bolts per lb.: James Du Bois, 3cents; Rowland A. Robbins, New York City, 2.44 cents; John Timmes, Brooklyn, N. Y., 2.4 cents.

Tompkinsyille, N. Y.—Metal Work.—Abstract of

cents; John Limmes, Brooklyn, N. Y., 2.4 cents.

TOMPKINSVILLE, N. Y.—Metal Work.—Abstract of bids received by the Light-house Engineer, Third District, May 5, for I ight-house and metal work of Castle Hill Light Station, R. I.: Builders' Iron Foundry, Providence, R. I., metal work, \$2,595; Phoenix Iron Co., Trenton, N. J., metal work, \$2,759; C. Rittenhouse & Sons, Norristown, Pa., metal work, \$4,114.31; Charles Sundberg & Co., Chicago, Ill., metal work, \$5,000; Murphy & Hayden New York City, I ighthouse, \$14,300; Charles Sundberg & Co., Chicago, Ill., Light-house, \$16,000.

MASHINGTON, D. C.—Torpedo Boat.—Only two bids were opened at the Navy Department on May 3 for the construction of a submarine torpedo boat, complete with torpedo appendages. They were as follows: Both bids from Wm. Cramp & Sons, Philadelphia, Pa.; first, to construct a torpedo boat patterned after the Nordenfeldt submarine torpedo boat No. 4, for \$175,000; second, a boat designed by the Nautilus Company, of New York, for \$135,000.

PROPOSALS.

(Continued from page viii.)

OFFICE OF LIGHT-HOUSE INSPECTOR, First District, Portland, Me., May 9, 1888.—Proposals will be received at this office until noon on Saturday, the 26th day of May, 1888, for furnishing and delivering at Portland, Me., one marine boiler and appurtenances for the light-house tender "Iris." Form for proposal, specifications, and full information can be obtained on application to this office. The right to reject any or all bids and to waive any defects is reserved. O. A. BATCHELLER, Commander, U. S. N. Light house Inspector.

FLOOR TILING, New York City.—Proposals are wanted until May 16 for furnishing and laying complete all the floor tiling required in the principal and gallery floors of the enlargement of the Metropolitan Museum o' Art in the Central Park. Address the Department of Public Parks, as above.

PROPOSALS.

Proposals for Pumping Engine OFFICE OF THE NEWARK AQUEDUCT BOARD. |
128 AND 130 HALSEY STREET,
NEWARK, N. J.

NEWARK, N. J. A

BIDS will be received at this office until 4 o'clock
p. M., Wednesday, June 6th, for furnishing a five
million (5,000,000) gallon Pumping Engine on Clifton
Avenue (tormerly Chatham Street.)

The Pumping Engine may be of the horizontal, duplex, beam or vertical compound type.
Specifications may be seen at the office of the Civil
Engineer of the Board.

The Board reserves the right to reject any or all
bids.

The Board reserves the reserves the bids.
Bids are to be addressed to the Newark Aqueduct Board and to be endorsed "Proposal for Pumping GEO R. GRAY, Superintendent.

WM. E. GREATHEAD, Secretary.

MAY 10, 1888.

MAY 10, 1888.

SEALED PROPUSALS will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 7th day of June, 1888, for the labor and materials required in the erection and completion of the Court-House, Post-Office, etc., building at Williamsport, Pa. (heating apparatus and completion of approaches not included), in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Builders' Exchanges at Pittsburgh, Pa., and Wilmington, Del, Master Builders' Exchange, Philadelphia, Pa., Master Builders' Association, Ealtimore, Md., Mechanics' and Traders' Exchange, New York City, Builders' Association, Buffalo, N. Y., and Builders' and Dealers' Exchange, Cleveland, O. Each bid must be accompanied by a certified check for \$1,000 WILL A. FRERET, Supervising Architect.

FRERET, Supervising Architect.

STEEL, Washington, D. C.—Proposals are wanted until June 4, for the following material for use in the construction of the United States armored cruiser "Maine." About twelve hundred tons of steel plates, from 5 to 26 pounds per square foot; about three hundred and thirty-seven tons of steel angles, of various sizes; about one hundred and one tons of steel angle bulb-beams, with proper curvature, from 15 to 30 pounds per foot; about six tons of steel I-shaped beams, 27 pounds aper foot; about twenty-nine tons of steel Z-bars, 12 pounds and 12 pounds per foot; about seven tons of steel Channel bars, 16 pounds per foot; about one ton of steel T-shapes, 14 pounds per foot; about one hundred and five tons steel rivets, from 36 to 36 inch diameter; about one hundred and forty tons steel castings, of various shapes, stem, stern-post, rudder-frames, shaft-tubes, shaft-struts, hawse-pipes, bitts, etc. For information and specifications, address William C. Whitney, Secretary of the Navy, as above.

MONUMENT, Boston, Mass.—Proposals are

MONUMENT, Boston, Mass.—Proposals are wanted until June 10, for the erection of a fireman's monument at the Forrest Hill Cemetery, near this city. Address Col. Taylor, Boston Globe office, as above.

SHAFT AND HEAD HOUSE.—New York City.
—Proposals are wanted until May 23 for deepening and finishing shaft No. 24, on Section A, of the new Aqueduct, and constructing a Head House connected therewith, and doing all other work necessary to complete said shaft as called for in specification. Address James C. Spencer, President Aqueduct Commissioners.

James C. Spencer, President Aqueduct Commissioners.
DEMOLITION OF BUILDING, New York City.
Proposals are wanted for the immediate taking down of the building known as French's Hotel, corner of Park Row and Frankfort Street. Address for particulars Business Manager, New York World.

POST-OFFICE BUILDING, Ottawa, Ontario.— Proposals are wanted until May 31 for the erection, etc., of a post-office building at Prescott, Ontario. For details address A. Gobeil, Secretary Department of Public Works, as above.

Public Works, as above.

CUT GRANITE, Washington, D. C.—Proposals are wanted, until June 2, for furnishing and delivering the cut granite, amounting to 9,500 cubic feet, more or less, required for the basement front walls of the western portion of the Congressional Library Building in this city. For details address William F. Vilas, of the Commission for the Construction of the Congressional Commission for the Construction of the Congressional Library, 145 East Capitol Street, as above.

BRIDGES, Cuming County, Neb.—Proposals are wanted, until June 5, for erecting two iron bridges. Address Jacob Shaefer, County Clerk, Cuming County, Neb.

ELECIRIC LIGHT, Washington, D. C.—Proposals are wanted, until May 10, for furnishing the material and constructing a system for electric light in the Interior Department Building. Address William F. Vilas, Secretary Department of Interior, as above.

WANTED.

PARTNER.—A thorough practical workman, with small capital, as partner in a well established and good paying Plumbing and Turning business; must be sober, reliable and competent to estimate, etc., and have unquestionable references. The right man is sought for, not the money. Address "New York Suburb," Box 282, this office.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s. brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apart nent-house ten, tenement; c, each s, owner; a, architect; b, builder; fr, frame.

NEW YORK. •

S s 146th, 315 w Brook av, 2 fr dws; cost, \$7,000 all; o, J F Brennan and D C O'Connor; a, H Dudley. 535 W 43d, br dw; cost, \$12,000;0, H Herbert; a, Jas W Cole.

256 and 258 Mott st, br and stone school house; cost 42,000; o, The Children's Aid Society; a, Vaux &

BUILDING INTELLIGENCE.

NEW YORK CITY-Continued.

r14th, br dw; cost, \$20,000; o, R McLaughlin;

E s Brook av, 50 n 144th, 2 br dws; cost, \$22,000 all: o, Carricto Bros; a, J C Burne.

E a Washington av, 375 s 171st, 3 br dws; cost, \$12,-00; o, Aug Berbert; a, C C Churchill.

80 Thompson, br ten and store; cost, \$14,000; 0, J A Baker; a, Jos Farnsworth.

Se cor 114th and Madison av, br flat; cost, \$30,000; o, H J Beaudett; a, W Baker & Co. S e cor Houston and Allen, br flat, \$30,000; o, Henrietta Pearson; a, Fred Ebling.

Ne cor 117th and 2d av, 2 br flats and stores; cost, 35,000 all; o, Eva Miller; a, Ed Wenz.

Es Main, opposite proposed line of Edgewater road, br gas works; cost, \$12,000; o, Northern Gas Light Co; a, F T Howe.

N s 122d, 280 w 4th av, br ten; cost, \$23,000; o, Wm Lyman; a Jas Henderson.

23-25 Nassau, br office bldg; cost, about \$100,000; o, Equitable Life Ins Lessees; a, Geo B Post.

220 Greenwich, br store; cost, \$24,000; 0, Estate of Ezra Miller; a, H M Smith & Son.

N s 143, 115 W Brook av, brick boiler house; cost, \$7,000; o, Boettger Hinze; a, R Obz & Geo Butz.
N e cor 123d and 3d av, br Commercial bldg; cost, \$100,000; o, Harlem Reformed Low Dutch; a, J R Thomas.

ST. PAUL, MINN.—The Gladstone syndicate pro-poses to erect thirty to forty houses this spring to accommodate the workmen employed in the shops located at the Gladstone suburb.

The Norwegian-Danish Methodist Society will erect a \$13,000 church on Broadway near Thirteenth Street

There will be twenty to thirty houses erected at Warrendale this summer, some of them to cost six or eight thousand dollars each.

Carroll, or Lewis, 3 story of double stores; cost, 15.000; o, F W Zietler.

Wabasha, nr 5th, 4 story br store; cost, \$18,000; o, Jacob Manizer.

Marshall av, nr Mackubin, 2 story br veneer dwell; cost, \$20,000; 0, C B Marvin.

Robert, nr Third, 1½ story add to store; cost, \$15,000; 0, J G Moulton.

Congress, near Onega, remodelling engine house; cost, \$7,000; o, M A Hensley.

Clinton, nr Susan, 2 story fr dwell; cost, \$7,000° 0, D A Darby.

W7th, near Forbes, 3 story store and dwell; cost, \$18,000; 0, J Horich.

WESTFIELD, MASS.—Cor Elm and Chapel, church cost, \$10,000; 0, 1st Universalist Society.

NEENAH, WIS.—The Polish Catholics will build a church and school building.

SPRINGFIELD, MASS.—Worthingtor, extending to Fort, 2 story br block for stores and tens; o, Heirs of the Wilcox estate; b, contract not let.

KEITHSBURG, ILL.-Drug store; cost, \$8,000; 0,

Brick store; cost, \$7,000; o. Mr Neutre. Dry goods store; cost, \$10,000; o, Magnet Co.

MILWAUKEE, WIS .- Cor E Water and Chicago sts, S w cor Biddle and Jackson, 2 br dws; cost, \$7,000; , estate of John Dahlman.

S Pierce, 6 dws; cost, \$8,000; o, Lorenz Seymer.

Howell av, church; cost, \$10,000; o, St Augustine Congregation. 62 buildings less than \$5,000.

NEW HAVEN, CONN.—High near Chapel; stone library; cost, \$125,000; o, Yale College; b, G M Grant.

Chapel, cor High; br block; cost. \$35,000; o, S W Hurlbut; a, R G Russell; b, C D Kinney.

Dwight, cor Chapel, wood addition to church; cost, \$7,000; 0, Dwight Place Church; b, Lowe Bros.

BOSTON, MASS.—Falmouth st, near Dalton, brick apartments; cost, \$72,000 o, a and b, Thomas R White.

Batavia, br apartments; cost, \$35,000; o, a and b, amuel Stubbs.

Newburg, cor West Chester Park; br apartments; cost, \$40,000; o, JS Gill; a, O H Drisko; b, O H Drisko & Son.

Tremont, near School, alteration of br stores; cost, \$75,000; o, FOHP Burnham; a, GJF Bryant.

13-17 School, br and stone offices; cost, \$55,000; o, H H Hunewell; a, Shaw & Hunnewell; b, L D Wilcutt.

MINNEAPOLIS, MINN.—The permit was taken out last week for the \$21,000 building of F. C. Pillsbury. C. F. Sawyer, the attorney, will commence the erection of a three-story brick and stone tenement on Fourth avenue and Twenty-sixth atreet at a cost of \$26,000.

The Minnehaha Driving Park Association will build five z-story barns near the corner of Twenty-seventh street and Minnehaha avenue at a cost of

Carl Peterson will build a \$15,000 2-story tenement at the corner of Fifteenth avenue south and Ninth

The Bennett Seminary Trustees will erect a building. D. W. Gillmore, secretary.

CHIPPEWA FALLS, WIS.-J B Theriault will erect a brick block on the corner of Bridge and Mill streets.

SAULT STE MARIE, MICH.--Fred Miller Brewing Co. will erect a branch establishment ace and refrigerator here. \$50,000.

EAST SAGINAW, MICH.—Mr De Camp will build-

BUILDING INTELLIGENCE

CHATTANOOGA, TENN.—Gilmer st, St. Patl's Catholic Church; cost, \$110,000; o, St. Paul's Church; a, Dedrick.

Cherry st, near 8th, 13-story brick stores: cost \$10,000; 0, H. G. Hall; a, not given; b, D I Chandler.

Front st, r warehouse; cost. \$18.000; 0, Loomis & Hart; a, not given; b, D I Chandier.

HOLVOKE, MASS.—Main st, cor. Cabot st, blocked stores and tenement; o, Lawyer Reardon; a, Aider-

GRAND RAPIDS, MICH.—Washington st. Red press brick veneer and sandstone trimmings residence; cost, \$12,000; o, W B Remington; a, W G Robinson; b, not let.

Robinson; b, not let.

The "Muskegon Club," of Muskegon, Mich, will erect a 3-story red press brick club-house, 42772; cost, \$15,000; a, S J Osgood: b, not awarded.

LANSING, MICH.—Large church and chape of lonia sandstone; cost, \$20,000; o, Presbyter an &ciety; a, not known; b, not known. IRONWOOD, WIS .- A \$25,000 hotel is to be erected

MANKATO, MINN.—A hospital is to be erected here. For details address General Tourtellotte.

LEWISTON, ME.—A school house, to cost \$30,000, is to be erected here. For particulars address the School Board.

DETROIT, MICH—A building to be used as a Sunday school is to be erected in this city by St Pauls Protestant Episcopal Church Society, at a cost of \$20,000. Details can be had of Rev Rufus W Cark, 763 Woodward Avenue, as above.

SPENCER, MASS.—A library building, to cost \$70,000, is to be erected here for Richard Sugden. The architect is H G Wadlin, 20 Beacon Street, Boston, Mass.

MINNEAPOLIS, MINN.—Knox av near 10th av N. wooden dw; cost, \$8,000; o, J N Stewart; a. J A Record

Cor E 20th st and 4th av S, br store and flat; cost, 15,000; o, F C Penney; a, Joralemon & Perrin. 1028 Knox av N, wooden dw; cost, \$7.500; 6, I Rock.

1216 Logan av N, wooden dw; cost, \$7,500; 0, F Davis,

Cor 1st av and 4th st S, bank and office bldg; cost, \$175,000; o, Nat Bank Commerce; a, H W Jones 2108-10 4th st N, br store and flat: cost, \$15,000; b and a, J C Plant.

River road N, bet 38th and 40th sts W, wooden saw mills; cost, \$82,000; 0, Borey & DeLaittre.

1512 Harmon pl, wooden dw; cost, \$8,000; 0, E N
Brown; a, H W Jones; b, A C Robinson & Co.

Cor Linden and 16th sts, N, wooden dw; cost, \$10,000; o, J H Thompson; a, W Murther.

Cor 3d st and 2d av S, foundation broffice blds; cost, \$25,000; o, N W Guarantee Loan Co. 1929 W Colfax, wooden dw; cost, \$7,000; o, R R Odell.

305-7 Oak Grove st, 2 wooden dws; cost, \$16,000; o, Brown & McIntire; a, Appleyard & Son. 2401-3 Harrison st N E, br store; cost, \$15,000: 6, Perry & Smith.

Cor 3d av S and 10th st, br dw; cost, \$18,000; e, F C Pillsbury: a, L S Buffington.

14th st and Clinton av, br tenement; cost, \$20 xxx; o and a, J L Record.

4th av S and 15th st, br tenement; cost, \$26,00:10 C F Sawyer.

15th av S and 9th st, br tenement; cost, \$15.000; 0, C Peterson. Lake Harreitt, wooden pavilion; cost, \$15,000; 0, T Lowry.

ST. PAUL, MINN.—The St Paul Park Improvement Co has sold too lots to a Chicago syndicate, represented by J C Cramer of that city, the conditions being that houses shall be erected thereon. About \$60,000 will be expended this year.

A B Wilgus will build 20 houses and flats on Ram-ey Hill, and 40 smaller houses in other parts of the

ALBERT LEA, MINN.—A \$20,000 hall is being talked of for Albert Lea College.

LA CROSSE, WIS.—W H Parker, superintendent of the new Government building, has received plats and advertised for bids, which will be received dur-ing May.

JERSEY CITY, N. J.—A new church edifice is to be erected by the society of St Mark's Church; cost, \$50,000.

CINCINNATI, O.—A \$100,000 armory building is to be erected here for the Ohio National Guard. S. Hannaford & Sons, of this city, are the architects, and none of the contracts have been let.

FINDLAY, O.—The Findlay Opera House Company has engaged Architect DS Shureman, of Cincinnat, to have charge of the erection of their new edifice to be built here at a cost of \$75,000. Address him at No 227 Main Street, as above, for details.

OAKLAND, CAL.—The Trustees of Mills College will erect a new building at a cost of \$13,000. For details address President Stratton.

PETERBORO, N. H.—An \$18,000 school building is to be erected here.

MANKATO, MINN.-Mr Saulpaugh will build a \$28,000 hotel nere. MINNEAPOLIS, MINN.—W E Steele is to erect a ten-story building on Third Street North; cost, \$75.

LS Buffington, architect, has just completed plans for handsome residence for LB Hart.

-Mr De Camp will build WA Barnes, will erect seven two-story houses, none less than \$3,000.

THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE ASSEMBLY CHAMBER CEILING.

Our issue of May 5 contained the report of the Expert Commission appointed to examine the condition of the ceiling of the Assembly Chamber of the New York State Capitol, and on another column of this number will be found a communication to the Speaker of the Assembly from the architects, Messrs. Eidlitz, Richardson & Co.

It will be remembered that the Commission found the ceiling to be in a dangerous condition and recommended its immediate removal, together with that of some adjacent portions of the building, amounting altogether to over 3,000 tons, in order to relieve the foundations, which were said to be overloaded. They also gave it as their opinion that the ceiling should be replaced by a much lighter structure of wood or metal, which for acoustic reasons they suggested should be flat.

As to the dangerous condition of the ceiling, and the necessity for the removal of at least the three central vaults, the architects do not differ from the Commission, but they do object on architectural and economical grounds to the replacement of the vaulting by a ceiling of wood or metal.

Provided that the acoustic question is not serious, about which there seems to be room for some difference of opinion, and that the foundations are not materially overloaded, which the statement of the Commission that their "settlement had been slight and not very irregular' would seem to indicate, or if the weight on them can be reduced to safe limits by the removal of other loads, such as the Commission suggest, it would seem as if the proposition to reconstruct rather than remove the vaulted ceiling was not unreasonable.

The difference of opinion on this point between the Commission and the architects probably arises from the fact that in reconstruction they do not have in mind exactly the same thing. The Commission charge, perhaps with justice, that "the ruin of the vaulted ceiling is due to the * * * design and method of construction and loading," and are naturally indisposed to countenance a repetition of the same errors with presumably the same results. On the other hand, it is not to be supposed that the architects have learned nothing by this extended and costly experience, and merely propose to "set 'em up again," trusting to better luck next time. They undoubtedly fully realize the defects of the present structure,

and would take pains to prevent their repetition.
Those who have carefully studied the description of this structure, given elsewhere in this issue, and the causes suggested for its failure, may perhaps agree with us that if the vaults are rebuilt as urged by the architects they could in two respects at least be made more stable. First, the vaulting instead of having its continuous joints horizontal, as now, should be composed of vertical rings or arches, of which a sufficient number at suitable intervals should be of such depth that the lines of pressures could be certainly contained in their "middle thirds." In other words, they would give stiffness to the vaulting, while the intermediate segments could be made enough thinner to keep the entire weight no greater than at present. Second, each arch or segment of the vaulting should set squarely on skewbacks formed on the main ribs, whereby all sliding or wedging and the distortions thereby produced would be absolutely avoided.

With these and perhaps other precautions that may be suggested, it would seem as if the defective vaults could be safely rebuilt, and to abandon them as beyond the resources of engineering skill is a confession of limitation in which neither engineers nor architects will readily concur.

The reconstruction with vaults of such design and with the provisos before stated we hardly think would be objected to by the Commission if the proposition were before them; and, if permitted, the result could not fail to be much more satisfactory, both from an architectural and engineering point of view, than would be likely to be the case with any cheaper substitutes.

QUARANTINE AND PUBLIC HEALTH.

IT seems that yellow fever has been lingering on throughout the winter in certain small towns in Florida, that it has been concealed and called something else, that no effort has been made to get rid of it, and that now it is to be used for a scare—Senator Call having introduced a joint resolution to give the Surgeon-General of the Marine Hospital Service one hundred thousand dollars to extirpate the fever, "provided that any exercise of power under this act in the interior of the State shall be done under the authority of the laws of the State and of the officers of the State properly charged with such duty." This means, of course, that because of the want of proper laws and legal authorities in Florida a conflagration has been started there which threatens to invade neighboring States, and that Florida is willing to put out the fire if the United States will pay her officials for doing so, but that she does not propose to have any outside authority interfering.

We have been hearing a good deal about the remarkable efficiency of the quarantines of North America recently. The merits of the present New Orleans system of disinfecting vessels, etc., have formed the subject of many laudatory editorials; the New York Quarantine, though somewhat damaged in reputation, is still supposed to be equal to any emergency, and now Dr. Montalembert brings out his report of the Grosse Isle Quarantine Station on the St. Lawrence, in which he tells us that "the season of 1887 marks the commencement of an entirely new era in the history of the quarantine system of the St Lawrence. * * * Canada has, for of the St. Lawrence. Canada has, for the first time, the assurance that every vessel from outside her boundaries which enters by the St. Lawrence will be inspected by a medical officer, responsible to the Government and to the country, before it is permitted to pass the Quarantine Station, etc.'

The St. Lawrence Quarantine is to be managed on very advanced principles. Not only are cases of measles, scarlet fever, and diphtheria to be quarantined, but Dr. Montalembert appears to be thinking about stopping cases of whooping cough. It seems that the St. Lawrence Quarantine has not yet got a wharf or a satisfactory dis-infecting establishment, and they need a new inspecting steamer and some more men, having at present only seventeen on the quarantine staff, nevertheless great improvements have been made and for these our Canadian friends deserve due credit. We need some repairs to our quarantine establishment of this city, and therefore do not feel like being very critical about those of others.

If every maritime quarantine establishment of the country were turned over to the United States, who should manage the business, pay the bills, collect the dues, and be responsible for the results, it would probably be the best settlement that can be made. No quarantine will permanently keep small-pox and yellow fever out of the United States—its adges are too big and ragged—but they may be deferred a long time, and this is worth doing. But if the United States pays the money, do not let it be paid to State officials.

THE POSITION OF RAIN-GAUGES.

MR. H. HELM CLAYTON, in a letter to Science, says of rain-gauges exposed on the roofs of houses: "The amount of rain caught becomes a function of the wind-velocity, a function of the wind-direction, and a function of other variants and variables, not least among which is a not uncommon change in the position of the gauge itself. Numerous experimental observations have shown that gauges exposed on roofs catch more rain when exposed on the side opposite to the direction from which the wind blows, and less rain when exposed on the same side from which the wind blows." *

For several years the rain-gauge of the Signal-Service Station at Boston has reported less than the normal rainfall and less than that given by other gauges in the immediate vicinity. This deficiency has been noticed since the gauge was removed from the roof of the Equitable Building to the top of a high tower on the Post-Office.

Mr. Clayton suggests no explanation further than the statement that "the amount of rainfall caught is evidently a function of the wind-velocity, and decreases with increased velocity of the wind." But it seems not impossible that the increased elevation of the gauge may have something to do with it, as all rain formed or moisture condensed on the falling drops below the gauge cannot be recorded by it.

THE ASPHALT PAVEMENTS OF BERLIN.

THE annual reports published by the municipality of Berlin afford some interesting reading with regard to the cost, etc., of the asphalt paving in that city since its introduction. The first experiments with Val de Travers asphalt were made in 1873. These proving satisfactory, a commencement on a small scale was made in 1877, when 2,556 square metres were laid down. From that year the extension of asphalt pavement grew rapidly. At the end of 1878, 23,586 square metres of the public streets of Berlin were paved with asphalt; at the close of 1879, 63,258 square metres; 1880, 106,223 square metres; 1881, 125,034 square metres. By April 1, 1883, 187,672 square metres of asphalt pavement had been laid down; at the same date in 1884, 253,586 square metres; in 1885, 322,042 square metres; in 1886, 359,409 square metres; in 1887, about 412,000 square metres. At present the superficies of asphalt paving in Berlin is about 470,000 square metres, and further 76,000 square metres have been ordered to be executed. The above figures show that asphalt pavement, notwithstanding its reported disadvantages, is in great favor at Berlin, at any rate. As to expenses, according to the Builder, a square metre of asphalt paving costs there on an average, 17 marks 50 pfennigs (17s. 6d.), while the cost of maintenance for twenty years, by contract, is 7 marks 50 pfennigs (7s. 6d.). The total cost per square metre of asphalt pavement for twenty years is, therefore, 25 marks (£1 5s). This is only 75 pfennigs (9d.) more per square metre than the cost of granite pavement. From the report of the municipality of Berlin, it appears that the complaints with regard to the slippery condition of asphalt pavement are gradually disappearing. On the one hand, great improvements, by the light of experience, have been introduced in the treatment of the asphalt; on the other hand, both "drivers and horses are getting more and more used to the new pavement." The cleansing of the pavement also leaves little to be desired, although only forty-five boys are engaged in the work of cleaning nearly 500,000 square metres.

A MAN in Leicester, England, was fined by the magistrate 40 shillings and costs for wasting water by allowing his water-closet cistern to leak water in the water-closet basin. If every one guilty of a like offense in this country was treated in the same way an enormous waste would be prevented.

NEW YORK STATE SIGNAL SERVICE.

THE bill establishing a State Weather Bureau has passed the Legislature and will probably become a law. It appropriates \$4.500 annually for the purchase and repair of apparatus and the dissemination of reports. It is proposed to have a signal station in every important town, usually in some school building, and to have every post-office supplied with bulletins.

The headquarters of the Bureau will be at Cornell University in charge of three commissioners, the Professor of Civil Engineering at Cornell, the State Superintendent of Public Instruction, and a third to be appointed by the Governor, all of whom, as well as the observers, are to serve without salaries. An officer from the U. S. Signal Service will be detailed to organize the Bureau and to have immediate charge of the central station.

There are similar bureaus already established in 30 other States and doing very valuable work in supplementing the national observations and reports and utilizing them for special localities.

HYDRAULIC POWER IN LONDON BUILDINGS.

HYDRAULIC power supplied from a central station is used in several London buildings. In the Hotel Metropole no less than seventeen hydraulic lifts are in use, working day and night.

Each of the seventy houses composing Kensington Court is fitted with a hydraulic lift, which takes the place of a back staircase. Altogether in London there are over 400 lifts which are worked from the mains, and a saving which is about 30 per cent. is said to be effected over steam-pumping. Next to lifts the power is mostly used for cranes and hoists along the riverside and in city warehouses. It is also used in London for pumping water for domestic use from the underlying chalk.

The power is supplied through mains under a pressure of 700 pounds per square inch. The water is kept at a temperature of between 60° and 85° throughout the year. Nearly 27 miles of mains have been laid. The charges vary from 2s. to 8s. per 1,000 gallons, according as the power is more or less continuously used. About 650 machines are worked in London by the hydraulic power.

THE EAST RIVER BRIDGE LIGHTS COM-PLAINED OF.

COMPLAINT has been made by pilots and shipmasters to the Lighthouse Board at Washington that the electriclights on the East River Bridge are so dazzling as to prevent them from clearly discovering the lights on other vessels or to judge of their distance.

Mr. C. C. Martin, the Superintendent of the Bridge, proposes to use screens or reflectors to confine the light as far as possible to the roadway.

SUNDAY LABOR IN GAS-WORKS.

THE London Journal of Gas-Lighting calls attention to the fact that the force employed during the day time on Sundays in the gas-works at Belfast had been reduced fifty per cent., and that a still further reduction was contemplated. One of the Gas Committee of the town had visited Glasgow, Preston, Manchester, Liverpool, Birmingham, and London, and reported that in five of these places there is a fifteen-hours' stoppage on Sundays, with the exception of about fifteen or sixteen days in each year. In the other towns, as in Belfast, there is simply a reduction of the force. The ability to stop work on Sunday of course depends on the storage capacity of the works.

M. A. DURAND-CLAYE.

La Nature of May 5 announces the death of M. A. Durand-Claye in the latter part of April last, at the age of forty-six years, after a short illness. He was a professor at l'Ecole des Beaux-Arts and at l'Ecole des Ponts et Chaussées, and an officer of the Legion of Honor. The establishment of the sewage farm at Gennevilliers was largely due to his labors. His numerous writings, in which are given the results of irrigation at Gennevilliers, his studies of the sewerage systems of Paris and other cities of Europe, are well known to our readers.

OUR ARCHITECTURAL ILLUSTRATION.

RESIDENCE OF MRS. SKINNER, BOSTON.—SHAW & HUNNEWELL, ARCHITECTS.

THE ASSEMBLY CHAMBER CEILING IN THE NEW YORK STATE CAPITOL.

THE ceiling of the Assembly Chamber of the Capitol at Albany is composed, as shown in the general plan, Fig. 1, of eleven groined vaults of various sizes. The central vault is 55x41 feet from centre to centre of the four main columns E E, which support its entire weight and from a half to a fourth of the weight of the eight vaults immediately adjacent to it, and is considerably larger than any similar structure that has yet been built.

The construction of these vaults is sufficiently indicated by the word "groined," but for those who may not be familiar with the term it should be said that each vault rests on two arched ribs springing diagonally from corner to corner and intersecting at an annular keystone in the centre through the opening in which the chandelier is suspended. A section of the ribs is shown in Fig. 4. The molded side is of course underneath and on the seats or offsets F F the vaulting N N is supported, which is cylindrical in shape (except the longitudinal arch of the main vault, which is curved in the direction of its length as well—see Fig. 2), and its horizontal joints are shown by the lines at N N, Fig. I. The square part of the rib projects up through the vaulting as shown in the plan.

Figure 2 is a longitudinal section on X X, Fig. 1. It gives an elevation of the wall K, and in connection with Fig. 3, which is a transverse section at Y Y, Fig. 1, shows the general arrangement of a system of wrought-iron ties designed to relieve the building of lateral thrust from the vaults and arched walls. Referring to Fig. 3 it will be seen that the thrust of the central arch is resisted by that of two half arches concealed in the wall and tied together at their crowns by the rods A A. The thrust of the small side arches is taken by the rods B D, B D, whose downward pull is resisted by suitable plates at B B. By this arrangement it is calculated that all of the wall above D D would be carried safely on the columns at E E, even if the side walls below D D were removed. A similar arrangement is shown in dotted lines in Fig. 2 at M L, L M, though not so necessary here, as the building might be supposed to be strong enough in the direction of its length to safely resist the arch thrusts, and for this reason the rods to support the small arches are omitted.

All these rods are intended to have such an initial tension put on them that they shall never, even when at their highest temperature and under their greatest strain, cease to compress the masonry which they embrace, and which, it will be noticed, has no openings in the line of the rods. This will prevent the rods from undergoing any change of length (relative to the masonry), and it is claimed that the only effect of possible changes of temperature will be to alter their tension within certain safe limits.

The external dimensions of the main ribs are 16x36 inches, and the vaulting varies from about 14 inches thick at the spring to about 10 inches at the crown of the main vault, and from 12 to 8 inches in the smaller ones. The pockets at the corners were filled up for some distance with concrete, but all above that point depended for its stability on its own equilibrium, with what assistance it might receive from the enclosing walls,

It is manifest that in a structure of this kind, whose tensile strength is very small and not to be counted on as affording any assistance, the location of the material and of the lines of pressure must very closely coincide, since if the lines of pressure get outside of the "middle third" of the thickness there will be trouble, and if outside of the thickness, ruin.

The vaults had not been long left to their own support before they began to show disturbed equilibrium in the opening of joints in the ribs, which in the main vault showed a tendency to open the inner joints a little above the haunches, to correct which, and the crushing of the edges of some of the outer joints observed some time later, a load was placed upon the crown of the vault with some success.

Just what caused this disturbance it is exceedingly difficult to say. As shown above, the line of pressure in the main rib could not vary safely more than six inches from a central position, and in some parts of the vaulting less than an inch and a half, and variations in the density of the stone and in its thickness, as the back was left rough, might cause material variations from their calculated position. The pressure lines would also be more or less disturbed by any settlement, compression, or shrinkage of the surrounding or supporting masonry. It is worth noting, however, that in these vaults, as in all sim-



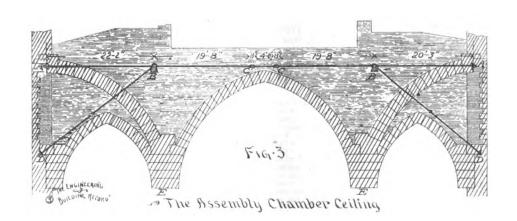
^{*} Due probably to the upward air-current on the windward side of the building.—E.D.



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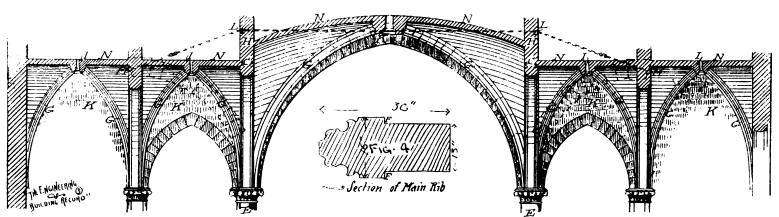
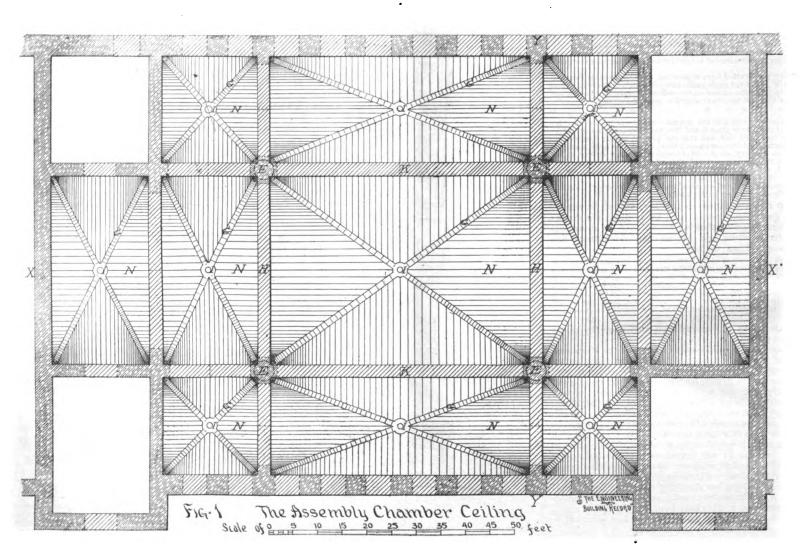


Fig. 2 The Assembly Chamber Ceiling



Digitized by

ilar structures heretofore built, the ribs are of uniform section, with no transverse offsets or projections of any kind to prevent the vaulting from sliding longitudinally upon them, as gravity would naturally cause it to do, and this sliding tendency is resisted solely by the cement and the friction. If such sliding did take place, some of the vaulting would soon become wedged between the ribs and the enclosing walls, and the horizontal reactions thus produced would tend to cause just such a deformation as has been described in the case of the main ribs. It will be noted, also, that the arches are pointed at the crown, and therefore, if not loaded at that point, are especially liable to this deformation.

STATEMENTS OF THE ARCHITECTS IN REGARD TO THE ASSEMBLY CHAMBER CEILING.

To the Honorable the Speaker of the Assembly of the State of New York :

The undersigned, in the interest of the State and of the architecture of the Capitol, which has received recognition as an advancement in the art of building and in justice to their professional reputation, respectfully represent that the defects of the Assembly Chamber ceiling at the present time are mainly due to neglect of recommendations made in 1882, and often repeated since, and that the proper course to be pursued at this time is to restore it to a safe and permanent condition. We are distinctly of opinion that this should be done both on architectural and on economical grounds, and submit the following reasons for this opinion:

The stability of this vaulted ceiling was carefully and scientifically examined by a commission appointed by Governor Cornell in 1882, in consequence of the fracture of a stone in one of the ribs of the main vault. Its conclusions are given in the following extracts from its

report:

"Immediately upon the organization of the commission we proceeded to get as correct an idea of the present condition of the Capitol as could be acquired from, first, an examination of the building; and the explanations of Major J. W. Eaton, the local Superintendent, who has been in charge of the work almost from its commencement, and a careful study of such drawings as were in his possession; second, from reports of sundry surveys and levels taken at various times by Mr. R. H. Bingham, City Surveyor; third, from the explanations of Mr. Leopold Eidlitz, who represented the architects in charge of the work.

"As to the result of these investigations, we find that the materials and workmanship of the building in general are exceptionally good; and we discover no defects worthy of special consideration other than those appearing in the Assembly Chamber and the portions of the building immediately above and below it. We have consequently confined our subsequent labors to a very careful, and, we believe, thorough examination of these defects, to an analysis of their causes, and to a consideration of their bearing upon the ultimate stability of the structure. To this end we caused a new set of levels to be taken, from which it appears that although no very unusual amount of settlement has occurred, the settlement has not been uniform."

"We have had the entire vaulting, with its supports and backing, measured, and their weights carefully computed, as a check to the accuracy of the quantities furnished to us by the architect, and we find that his calculations are substantially correct."

"We have critically examined the plans of Mr. Leopold Enditz, architect, for the construction of the Assembly Chamber and the work connected with it, and have given due consideration to his very full and clear explanations of his computations and methods of construction.

"If we could be sure that the unequal settlement of the foundations had permanently ceased, and that they were capable of safely bearing an increased load, and that the present mixed construction of flying arches and iron rods would always hold the arch springers with absolute rigidity, we should recommend that the ceiling of the Assembly Chamber be recentered, that all broken or defective stones be replaced, and the main side vaults brought into stability by rebuilding or readjustment of loads."

'The cracks in the 'red corridor' under the Assembly Chamber are no evidence of danger to the building.

In our communication to the Governor of November 17, 1882 (hereto annexed in full), we resolved the doubts of the Commission by showing clearly that the abutments were perfectly secure, and that no unequal settlement had taken place. Hence we said:

"We find in the report of the Commission no warrant for any further recommendation, except that the fractured stone still remaining in the main vault be replaced; that the work be properly pointed, and that the equilibrium of all the vaults be reviewed, and, if need be, corrected. Nor can we find in the report warrant for any other opinion than that when these slight repairs are made the vaulted ceiling of the Assembly Chamber will be a perfectly sound and permanent structure."

Since the above recommendation was made by us six years have passed

The theoretical proof presented by us that the abutments are secure has been confirmed by a recent examination, and the conviction expressed that the differences of level of the bases of the granite columns are due to irregularities in building and not to an unequal settlement, is now proven practically by a recent report of Mr. Bingham, which shows that the relation of the levels of the two columns in question remains the same as it was in 1882.

It will be seen that the statements of the Commission of 1882 as to what it would recommend could it be satisfied as to the security of the abutments and foundations is substantially identical with our own recommendations of what should be done. This recommendation was not carried out and nothing has since that time been done in pur-suance of it. The present condition of the vaulting differs from its condition in 1882 only by the deterioration consequent upon this neglect. The neglect has occurred in

spite of our urgent and repeated appeals to the Commis sioners of the Capitol and the Superintendent of Public Buildings, who severally explained that they had no power in the premises. These appeals being without result, we finally addressed, May 25, 1887, the following letter to the Trustees of Public Buildings:

To Hon. David B. Hill, Hon. Edward F. Jones, Hon. James W. Husted, Trustees of Public Buildings, and Hon. Charles B. Andrews, Superintendent of Public Buildings.

During the past eight years various communications made by us to the present Commissioner of the Capitol and to his immediate predecessors, relating to the completion of the Assembly Chamber vaults, to the regulating of their equilibrium and to repairing injuries done by the long neglect in doing this necessary work, have not been acted upon. The reason these communications were not acted upon is, we are assured by the Commissioner, that he has no power in the premises by reason of Chapter 205 of the Laws of 1882, which withdrew the Assembly Chamber, together with other parts of the building (by that law declared to be completed), from the care and supervision of the Capito Commissioners and placed them in the hands of the Clerks of the Senate and Assembly and other State officers, and by reason of Chapter 249 of the Laws of 1883, which created the Trustees of Public Buildings, who are now entrusted with the care of the so-called completed portions of the Capitol.

Being left without power or authority to carry out the work which we deem absolutely necessary for the preservation of the Assembly to exhaust the last possible resource left open to us whereby our recommendation in the premises may be officially recognized.

We herewith repeat the request heretofore made of the Commissioner of the Capitol that you appoint one or more competent persons

sioner of the Capitol that you appoint one or more competent persons conversant with the theory of arches, who shall in connection with

us examine the vault of the Assembly Chamber, which upon its condition and recommend such repairs as all perfect its construction. "The Assembly Chamber," we say in our last report missioner of the Capitol, "should not be given up should its reputation be permitted to be assailed for walligent and authoritative expression of opinion as to its tion, or for want of the necessary funds to complete it and keep it in repair."

Our professional reputation should not be permitted not should we be held responsible for the integrity of our recommendation, to do necessary work for its complencessary repairs for its maintenance are not acted upon Submitting all this to your favorable consideration that you will take such action as the case deserves, we Yours very respectfully, EIDLITZ, RICHARI The Commission appointed by the Assembly luring the

The Commission appointed by the Assembly present session, whose report of April 26, 18 before us, sums up the defects of the Assemb by the statement that

"The ruin of the vaulted ceiling is due to the fact the and method of construction and the loading of these archas been such as to give pressures which have resulted the design togration of the structure."

This means that these vaults are either not a equilibrium or that they have been out of equilibrium: and that the injury done at that time has not becorepaired, or both, and this conforms to our own concl sions and

those of the Commission of 1862.

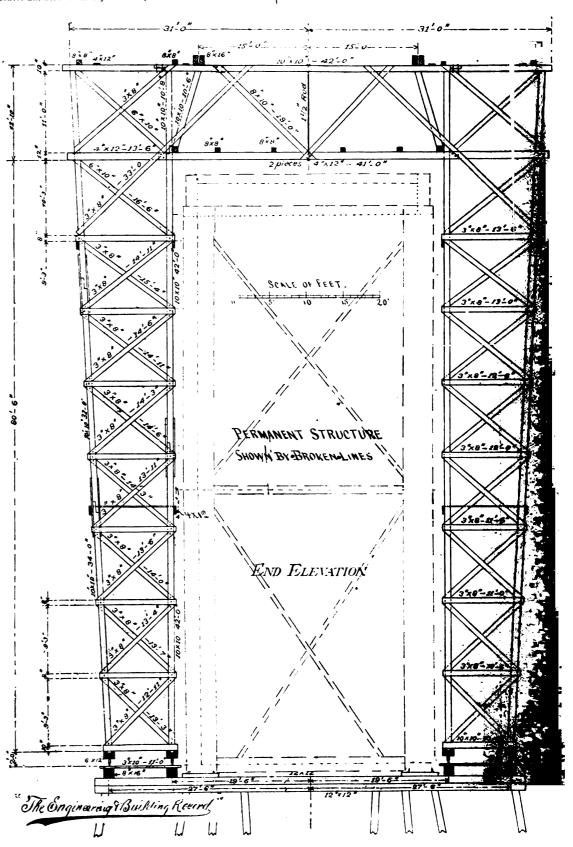
The present Commission nevertheless recon nends the demolition of the vaults and of various other masses of

hall report

be assailed, work while

luring the

Chamber



POUGHKEEPSIE BRIDGE. FIGURE 22.

masonry, and the substitution of wood, metal and slate, in order "not to throw lateral pressure on the outer wails, and so as to load the supporting walls below the Assembly Chamber as little as possible." Inasmuch, however, as in fact the present ceiling throws no lateral pressure on as in fact the present centing throws no fateral presented the outer walls, as the supporting walls below the Assembly Chamber are not overloaded, and as the Commission itself reports that "the settlement of the foundations has been slight and not very irregular," * thus showing that they are not overloaded, the extensive demolition proposed seems to be quite unnecessary. The deterioration, the cause of which we have already explained, has advanced so far since 1882 that in place of the "slight repairs" we then recommended it may now be necessary to reconstruct the three central vaults; but we can see no reason, engineering, architectural or economical, why the vaulting should be replaced by "a ceiling of wood or of metal." If it would be discreditable to the State that the vaulted ceiling should fail, through unscientific construction or through neglect, it would not be less discreditable to the State that it should be superseded for insufficient reasons. All of which is respectfully submitted.

EIDLITZ, RICHARDSON & CO.

Note.—This paper being confined to the question whether the vaulted ceiling of the Assembly Chamber's ould be repaired or superseded, only incidental mention is made in it of those findings and recommendations of the Commission which do not relate directly to that question. It is not, however, to be interred that the architects assemt to these

BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXXIV.

(Continued from page 336.)

ERECTION OF POUGHKEEPSIE BRIDGE.—NO. 4.1

TRAVELERS

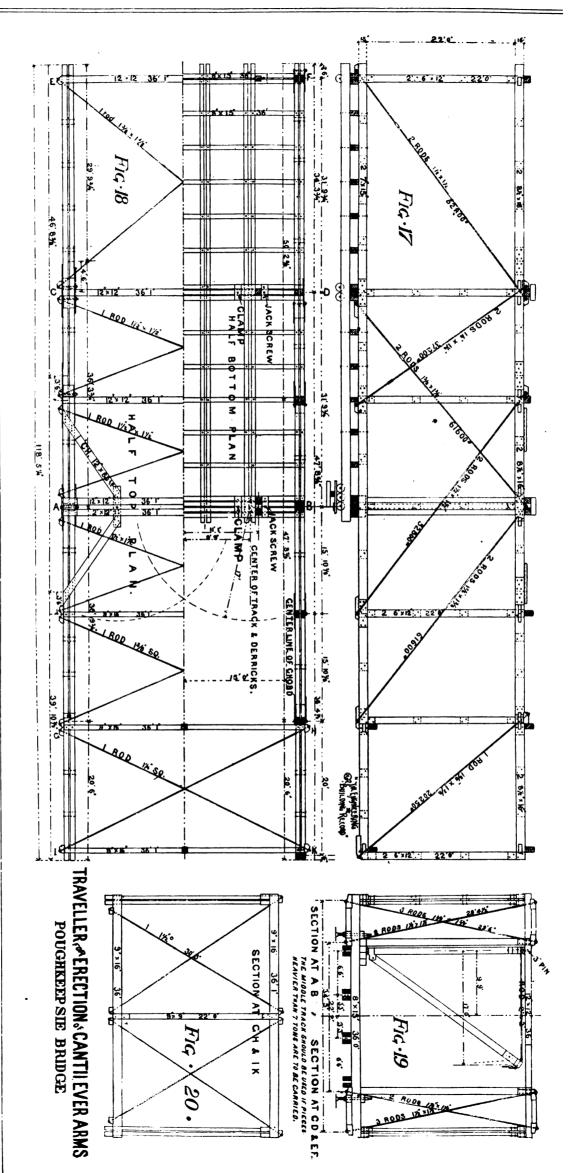
FIGURE 21 is a transverse, and 22 a longitudinal view of the traveler designed to erect the 525-foot spans. It is nearly 70 feet long by 100 feet high, and 60 feet wide on top. The posts and transverse bracing are of timber, and the longitudinal tie-rods of iron. It is carried by 16 double-flanged wheels on four rails. There are two working platforms at convenient heights for making connections in top and intermediate planes of lateral bracing. On top, over the centres of the chord lines, are longitudinal girders, to which hoisting tackle may be attached at any convenient point.

The traveler clears the completed permanent structure, and is thus able to run back and forth over it in either direction at any time.

This is one of the largest and tallest travelers ever used and its erection on top of the 130-foot false work was a somewhat difficult feat. The timbers having been duly framed, one bent (as seen in Fig. 21), 100 feet high, was put together in a horizontal position on the tops of the caps of the false work. Hoisting ropes and back guys were then attached to the top and at two intermediate points part way down on each side. The heel was placed square, abutting against foot blocks and lashed securely. The upper end of the bent was then blocked up a few feet, and Mr. Robert Baird directed the pull on the hoisting ropes with tackles to the drums of the hoisting-engine. The strain was so carefully and evenly applied that the timber frame slowly revolved into a vertical position without crippling or seriously buckling. It was rigidly guyed and the other bents readily hoisted by tackles led from the top of the first one. This traveler is equipped with ten sets of tackle having 16' double and triple blocks and 11/2 rope, and is capable of hoisting simultaneously two of the heaviest chord pieces, having a total weight of 68,000 pounds. To move it lines are simply led from it to the drum of the stationary hoisting-engine, no purchase being required.

Figs. 17, 18, 19 and 20 show the overlanging derrick by which the cantilever arms are erected. It is essentially an uneven paneled Whipple truss, with iron rods for diagonal ties and the other members of timber. It is 20 feet deep and nearly 120 feet long, moving on four rails, each of which supports six wheels in three groups. The overhang is about 50 feet, sufficient to reach over two panels of the cantilever arm. It has transverse girders at each of the three panel points of top chord, from which are hung snatch-blocks to lead the hoist-lines as required. Swinging platforms, not shown in figure, are hung by hookbolts from lower chord of overhang, and from there the connections of permanent structure are conveniently made.

⁺No. 1 of these articles, containing the General Description and an account of submerged work, appeared in our issue of March 3; No. 2, Masonry, issue of May 5; No. 3, False Work, issue of May 12.



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^{*} Not at all irregular would have been a more fitting term in the light of recent surveys.

The following end of the traveler is rigidly constructed with double vertical posts six feet apart transversely, with diagonal ties between. There are in the floor system, besides the lower chords, four lines of double longitudinal stringers, together with transverse beams, floor joists, and heavy planking, all thoroughly bolted together. At the point of beginning of overhang extra heavy transverse beams are put in top and bottom and stiffly knee-braced in horizontal plane. Fixed between these beams, 20 feet apart, are two derricks with 27-foot booms with a swing of 270 degrees each. The forward roller wheels, in groups of three, are nearly under the derrick foot-blocks, and afford direct bearing for transmission of their loads to the supporting truss. Adjacent to the two forward sets of roller wheels, jack-screws and clamps are fixed to the transverse beams, the former to remove the bearing at will from the wheels, and the latter to grip the truss beneath and thus securely anchor the traveler for the duty of hoisting heavy members at its outer extremity.

The rear part of this traveler is floored and partly housed in. It carries a 6-spool hoisting-engine, with boiler, pump, and necessary tools and equipment, while ten or twelve sets of tackle, besides hand lines, single blocks, etc., are required on the overhang. The traveler is moved by fixing a line to the most advanced part of the finished work, and winding up to it, without additional purchase on the spool of the hoisting-engine.

(TO BE CONTINUED.)

THE BROOKLYN BRIDGE TERMINAL QUESTION.

THE following report, which we take from the Brooklyn Eagle, of the remarks of Mr. T. C. Clarke, M. Am. Soc. C. E., and the expert member of Committee on Terminal Facilities of the Trustees of the Brooklyn Bridge, and the action thereon, is of interest to our readers. A motion to reopen the matter was under consideration .

Trustee Clarke asked the privilege of making a personal explanation. He said his action had been assailed and he desired to defend himself. He also opposed reconsidering the vote. "If we go on and continue this examination what will we have to do next?" he queried. If the trustees had done what Wellington accused them of having done, Mr. Clarke said, they would have been fools. Without taking into account the great amount of land required by Wellington's plan it would not have been wise to adopt it,

As the proposed system had been misunderstood by many, Mr. Clarke thought it best to explain it. No defense had hitherto been made, but he proposed to undertake it. In order to be placed on record correctly he had prepared a statement. This he proceeded to read. It was as follows:

The board is asked to reconsider its action at its last meeting by which it adopted several terminal plans. If this can be shown to be for the public good I shall vote for it. At present I can see no reason for questioning the wisdom of the course adopted on the 17th of April.

for questioning the wiscom of the course adopted on the 17th of April.

It has been publicly stated that the estimates of the Chief Engineer were falsifications of fact and were intended to deceive the Board by exaggerating the cost of a certain patented plan in order to prevent its adoption, the inference being that if this gross charge were true we should hasten to reconsider our action and adopt that rejected plan as the best that could be devised. Moreover, in order to strengthen this position, I, as an expert member of the late Terminal Committee, am misrepresented as saying that I amin favor of this patented circulating 18-car plan with its manifest absurdities and dangers. I deny this. I look upon it with the utmost distrust. What I did say and do now report is that I amin favor of a circulating

system which will do away with locomotives. So far I agree with the late Board of Experts. What that circulating system is I will explain

The statement then goes on to say:

I he statement then goes on to say:

The rejected patent system is most dangerous for the reasons given by our Chief Engineer in his letter of April 10. Can saything be more dangerous than to have a train of eighteen cars full of passengers running down a grade of 175 feet per mile with another similar train standing only 352 feet in front of it? Should the grip fail to let go or the brakes fail to work, the heavy eighteen-car trains standing on the main track could not be got out or the wav in time to prevent a disaster too s hocking to contemplate. This Board, I am proud to say, has always placed safety in working as the first, the last, the only consideration, and the results so far have justified the wisdom of this a tion. I for one do not intend to leave the path of safety.

last, the only consuceration, and the actual state of the path of safety.

About a year ago when it became evident that means should be taken to increase the traffic facilities a plan was presented to you by an engineer of the highest standing, Mr. C. E. Emery. Mr. Fmery proposed to lay two distinct sets of rails all over the bridge, which at the end stations should diverge into two parallel tracks with plainforms between. So far this plan was entirely safe, but he also proposed to take trains out in face of, and crossing incoming trains. This was undeniably dangerous, and, therefore, his plan was not adopted. Mr. Emery, however, is a gentleman, and did not think it necessary to accuse the Chief Engineer and this Board of ignorance, mecompetency and fraud because they did not adopt his plans.

The statement summarizes the advantages of the plan

The statement summarizes the advantages of the plan adopted as follows:

adopted as follows:

The plan adopted by you at the last meeting is like Ergery's as to bringing in the trains. To take them to the outbound tack it continues the long-used and safe practice of tail switching. It is absolutely safe. No full trains cross each other, and if an incoming train runs away there is always an empty track for it run upon.

What future improvements can be made in this? Not to make it safer, for this cannot be done. But instead of switching the trains by locomotives, which are very expensive and noisy, it is possible to bring the trains around curves in the rear of the platforms. This can be done by auxiliary cables. By this double system a capacity greater than that claimed for the rejected patent system can be attained.

You will ask why was not this system (the auxiliary cable) recommended for adoption by the Terminal Committee? It is the circulating system that we approve of. It is absolutely safe. It gives the greatest possible number of cars per hour and it does away with locomotives.

the greatest possible number of cars per hour and it does away with locomotives.

The answer is its enoimous cost, chiefly owing to the great amount of new land required. Here you have a complete answer to the attacks upon us of exaggeration and falsification. Why should we wish to exaggerate the cost of a system that we would like to adopt? The charge is as absurd as it is scandalous. We said in the report of April 17: "In this age of inventions there is no knowing what the next seven years will produce."

What we had in mind was that the same ingenuity which has enabled trains of five cars to go around curves of ninety feet radius on elevated roads, instead of 240 feet radius—the least previously known—may be trusted in the future to devise methods of modifying our cars, their track and wheels, and possibly the curved rails, so as to enable them to run around curves of much less than ninety feet radius. If this can be done the way to future enlargement is clear. Take out the rear switching-track and connect the platform tracks by curves of as small radius as possible, which will require comparatively little more lands and station space than we now have. Until this is done we will use the plan adopted at last meeting.

At the conclusion of the reading of Mr. Clarke's state-

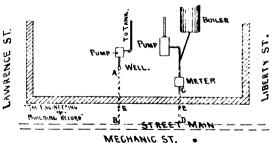
At the conclusion of the reading of Mr. Clarke's statement Mr. Higgins again took the floor, an I while he did not agree with Trustee Bush that Wellington had forfeited all claims to consideration, he admitted that "Weitington has assailed the honor of every member of the board in sending us the communication that has been received." He asked, however, if Wellington was not a reputable man, and Mr. Bush retorted that he was not in the habit of attacking such people. The latter did not propose to stultify himself by acknowledging that Wellington's

charges had anything to stand on.

By a yea-and-nay vote Mr. Bush's motion to lay the matter on the table was carried, Mr. Higgins voting against it and his dozen associates indorsing Mr. Bush.

A DEVICE FOR EVADING A WATER-METER.

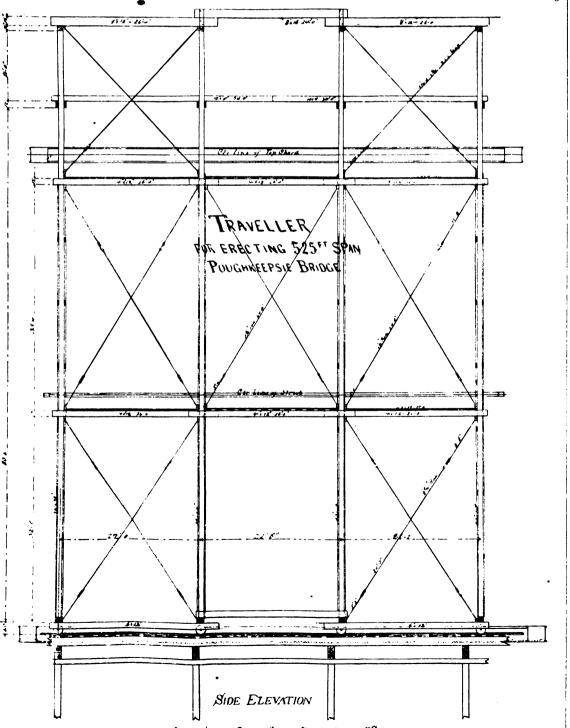
In December, 1882, the Newark Aqueduct Board placed a meter in the corset manufacturing shop of Heilner & Straus, Newark, N. J. On January 26, 1883, when the February bills were made out, the meter showed that 31,500 feet had already been used. The next quarterly reading of meter showed only about 14,000 feet for a full three months' use, the diminished rate being explained as due to the use of an additional supply from a driven well from which they were pumping. This seemed plausible, and no



suspicions were entertained until recently a discharged employee of the corset company revenged himself by informing the Aqueduct Board that the company were drawing water from the street main through a secret pipe. An investigation showed the arrangement represented in the diagram.

D C is the legitimate branch from the main, passing through the meter and supplying boiler, etc.

A B is a concealed pipe, one inch in diameter, that is hidden under the floor, and connects with the suction-pipe of a rotary pump by means of a tee some distance below its entrance into the well, A. E and E are stop-cocks in the branches.



POUGHKEEPSIE BRIDGE. FIGURE 22.

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The well-hole at A is only two inches in diameter and twenty-eight feet deep, and is found to yield little or no

The pump, apparently drawing from the well, is really fed by branch A B, and delivers to a roof-tank which supplies all the closets, basins and other domestic requirements of the building.

Estimates are being made of the probable amount of water abstracted, and the value, which may amount to \$1,000 or more, will be collected by the Aqueduct Board.

For the sketch from which the diagram is copied and the facts here recited our representative was indebted to Mr. George R. Gray, Superintendent of the Aqueduct

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A REGULAR meeting was held Wednesday evening, May 16. Vice-President I. I. R. Croes presided, and a large attendance of members and guests was present. The loss by death was announced of Henry F. Walling, Mem. Am. Soc, C. E., and the appointment of a committee was authorized to prepare a memoir.

The paper of the evening on "High Walls or Dams to Resist the Pressure of Water,"* by James B. Francis, Past President Am. Soc. C. E., was read by the author and discussed by Messrs. W. W. Maclay, F. Collingwood, J. P. -Frizell, General G. S. Greene, A. Fteley, Theodore Cooper, C. E. Emery, B. S. Church, and Mr. Wegeman. Further discussion of the paper is promised at the next meeting and at the annual convention.

He commenced by deducing from some experiments by Gen. Gillmore on the crushing strength of stone, in which that strength per square inch increased with the cross section of the specimen, the conclusion that the resistance of the material to crushing was not uniform, but increased with the distance from the perimeter, and illustrated the principle by reference to the supposed condition of rocks at great depths, and to observations on the behavior of the clay through which the Chicago water tunnels were constructed.

He then investigated the conditions of stability of a dam of right angled triangular section under three different conditions-first, when the resultant of water-pressure and weight of dam passes through the down-stream toe; second, when the resultant passes through the down-stream boundary of the middle third of the base, and in the third case the resultant passed through the same point; but the assumption was made of a lifting pressure, due to water-filled seams in the underlying rock, uniformly diminishing from full head at the up-stream toe to nothing at the down-stream one.

The height of the dam being equal to the depth of water and taken as I, the width of base for specific gravities of materials of 21/4 and 21/2, respectively, are found to be as follows: in the first case 0.4714 and 0.4472; in the second 0.6666 and 0.6325, and in the third 0.8944 and 0.8165.

In the first case the factor of safety was o and in the second and third cases it was said to be 2, which seemed to be considered sufficient. Owing to the irregularity of the horizontal joints it was concluded that in a dam proportioned to be safe against overturning there was no danger of failure by sliding.

In regard to failure by crushing, it was concluded that in accordance with the principle deduced at the opening of the paper the maximum pressure would not be outside of the middle third of the base and would probably not exceed the average pressure by 30 per cent., and that therefore no danger from that cause was to be apprehended.

Then followed a record of some experiments made to determine whether the upward pressure from water-filled seams in the underlying rock would extend beyond the parts of the masonry immediately in contact with the seams, the conclusion being that an upward pressure may be transmitted through the mortar to the entire base.

BOSTON SOCIETY OF CIVIL ENGINEERS. CONSTRUCTION AND VENTILATION OF SMALL PIPE-SEWERS.

REGULAR meeting of the Boston Society of Civil Engineers was held May 16, President Desmond Fitz Gerald in the chair

Mr. William E. McClintock, City Engineer of Chelsea, read a paper entitled "Construction and Ventilation of

* As the rules of the society do not permit the publication of papers in full in advance of their publication in the proceedings, and as Mr. Francis' paper was too concise to be materially excised or condensed without mutilation, we give nothing more than an outline at present, proposing, as soon as we are at liberty to do so, to give it in full, with the discussion thereon.

Mr. F. P. Stearns, Chief Engineer of the State Board of Health, read a paper and discussion on the same sub-

Written discussions on the subject by Messrs. F. Floyd Weld, City Engineer, Waterbury, Conn.; G. T. Nelles, City Engineer, Leavenworth, Kan.; George A. Kimble, Somerville, Mass.; William P. Pierce, Borough Engineer, Stamford, Conn.; A. R. Sweet, Engineer and Super-intendent of Sewers, Pawtucket, R. I.

A general discussion followed among the members, by Messrs. E. C. Clark, F. P. Stearns, Henry Manley, D. Fitz Gerald, H. H. Carter, S. Smith, O. F. Clapp. Fiftynine members and seventeen visitors present.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met May 2, 1888, President Holman in the chair. William H. Bryan, Secretary, thirty-four members and three visitors present. Prof. A. E. Phillips was elected a member.

Prof. Nipher, chairman of the committee to which was referred the communications on national asked the members to present any information they might have on the subject.

Prof. Johnson, librarian, reported the completion of an

index of the club's books and pamphlets.

Mr. Wheeler read the action of the Engineers' Club of Kansas City on the subject of improvements in highway bridges. The St. Louis Club was asked to co-operate in securing needful legislation. The matter was referred to a committee consisting of H. A. Wheeler, C. H. Sharman and M. G. Schinke.

J. A. Ockerson resigned the office of vice-president on account of continued absence from the city. Col. E. D. Meier and J. A. Seddon were nominated to fill the vacancy, the latter withdrawing his name; the election is

to be by letter ballot, to be reported at next meeting.

Col. E. D. Meier then read a paper on "The Prall
System of Distributing Heat and Power from Central
Stations." He called attention to the low efficiency of
methods heretofore employed, and gave a detailed description of the Prall system, which he believed offered a solu-tion of many of the difficult problems involved. Water was heated to a high temperature and then pumped through the pipe system at greatly increased pressure. At certain points it was converted into steam or water at

lower pressures for heating, power, cooking or other uses.

The subject proved of very general interest, and was discussed by Messrs. Wheeler, Nipher, Blaisdell, Woodward, Jones, Seddon, Gale and White. The practical trial of the system at Boston* during the past winter had resulted favorably, and extensions were now being planned.

Mr. White's paper was made the special order for the next meeting, May 16.

ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting was held May 7, 1888. The following were declared elected as members: Daniel Bontecon, O. B. Gunn, E. J. Farnsworth, Alexander Potter, M. N. Wells, William B. Upton. As associate members: H. F. Hill, F. C. Florance.

The Secretary read two communications from Mr. B. The Secretary read two communications from Mr. B. W. DeCourcy, of Independence, Kan., describing some piers and abutments recently erected in Montgomery Co., Kan., which had failed or were considered unsafe, also a bowstring girder in the same condition, stating that the county had lost considerable money in neglecting to procure professional advice. The Secretary presented for Mr. DeCourcy two photographs of the work with specimens of the stone. The Secretary made a few remarks on the above masonry which he had been called upon to inspect, and presented results of tests of the stone made by spect, and presented results of tests of the stone made by Prof. J. B. Johnson of St. Louis.

Mr. Donnelly being unable to present his paper on "Kansas City Pavements," Mr. Mason gave a brief description of those in use here, and especially of the Trinidad asphalt pavings, a specimen of which from one of the Omaha streets he presented to the club. Mr. Mason believed that asphalt would eventually be the principal paving material used here on account of its durability, the ease with which it could be kept drained, and as it is found to be serviceable on grades as steep as eight per cent.

Correspondence.

THE NEED OF GOOD INSPECTORS OF MASONRY.

16 LAFAYETTE AVENUE, BROOKLYN, N. Y., May 15, 1888.

SIR: The bad work in the masonry lining of the Croton Aqueduct conduit, which is the subject of the report of Messrs. Church and Rice, published in the last number of THE ENGINEERING AND BUILDING RECORD, recalls an experience of mine some 20 years ago that illustrates the absolute need in all such contract work of inspectors-and of good inspectors-men who know good work from bad, and who cannot be hoodwinked or bought up by the contractors. In the case of the aqueduct it may be possible

*A description of the "Plant of the Boston Heating Company" was commenced in our issue of April 28.

by sounding to detect the bad work and have it all taken out and properly reconstructed, though there is always some uncertainty whether more or less of it may not have been undiscovered; but in larger masses of masonry it is quite impossible, if there has been no competent inspector, to know what may be the condition of the interior of the work after its completion.

At the time alluded to I had charge as engineer of the masonry of various kinds--arched bridges, culverts, bridge piers, etc., which were being substituted for trestle work over some 200 miles of road in operation in Western Pennsylvania and Ohio, as well as new brick round-houses and considerable other work. I had no assistant, and the management was altogether too parsimonious to allow anything so superfluous, in their estimation, as inspectors constantly on the work. I was unable to be present on any one piece of work more than two or three hours in a week.

For the piers and abutments of a three-span Howe truss, the c ntractors had purchased the stone of some old canal locks. Those that I allowed them to use were of very good material, as some 30 or 40 years of exposure in the locks had demonstrated, and the beds and joints were all exceedingly well dressed-much better than the general run of railroad masonry in that region, admitting of much closer mortar joints. Unfortunately for one of the piers, the dressed stone as delivered would not, with a certain number of courses and with proper beds of mortar, quite reach up to the bridge seat, lacking perhaps three or four inches. The foreman did not want the trouble or expense of cutting one or two new courses, and so made up the needed height by putting in heavy beds of mortar and driving with a free hand barrel staves into the joints to keep the stone up. The joints were all carefully pointed to hide the staves; but on one of my weekly visits, the joints striking me as being pretty heavy, a little scraping and examining revealed the end of one of the staves, and the trick was fortunately discovered. Of course, the whole pier had to come down; but with the little time I had to devote to each piece of work, and the joints that were allowable in the class of masonry called for by the contract, it would not have been surprising if this flagrant attempt at deception had succeeded, the piers had been accepted and paid for, and the weight of the trusses and J. FOSTER FLAGG. trains transferred to them.

REPORT OF EXPERIMENTS ON BUILDING MATERIALS AT WATERTOWN ARSENAL.

COLUMBUS, O., May 14, 1888.

SIR: Please inform me how or where I can obtain a copy of the report of "Experiments on Building Materials," made at the Watertown Arsenal and referred to in an artiindee at the waterload Also and the referred to main after the on "Strength of Cement Mortars," in The ENGINEER-ING AND BUILDING RECORD of May 5, 1888, and oblige, Yours respectfully, F. W. FAY.

[We presume it is a public document and can be obtained through your Congressman; if not, we suggest you address the U.S. A. officer in charge of the arsenal.-ED.]

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, oeing governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

AN ELECTRIC RESERVOIR GAUGE.

AT Bridgeton, N. J., the necessities of the high service require the water in the reservoir to be kept as near the top of the bank as possible, which, as the pumping station is half a mile away, requires much care to avoid an over-flow such as recently occurred with considerable damage to the bank.

Superintendent Timothy Woodruff has, with the assistance of Mr. Samuel Mayers, an electrican, devised and erected, at an expense of \$75, an electric water-guage which indicates at the pumping station by sight and sound the water-level for every six inches of the upper four feet of its range, which is expected to obviate all further

A FLOATING BRICK-KILN.

J. C. Anderson, of Highland Park, Ill., has patented a scow arranged to receive brick from the brick machine, and provided with a kiln in which the bricks are burned while being transported to market without further hand-



DOMESTIC ENGINEERING, ETC., IN THE CENTRAL TRUST COMPANY'S BUILDING, NEW YORK CITY.

No. III.

(Continued from page 329.)*
PLUMBING.

THE office wash-stands are uniform throughout the building, as shown in Fig. 8, where the wall panel, sides, and safes are of Italian marble and the pipes, fixtures, and legs of polished brass. The table is in one heavy slab, with molded edges, and has a large oval porcelain bowl.

modious wash-stand at the right has a large oval porcelain basin, supplied with cold water; its table and facing are marble, and the floor beneath it, as well as that in the closet, are of marble. An inclined marble safe is beneath the urinal, and the remainder of the floor, as shown, is of small white ceramic tiles, neatly edged with a narrow brown border of the same material. The closet cistern is enclosed with marble panels and carried at one end in the wall and at the other by suspension rods from the ceiling.

The pipes and all the fixtures are of polished brass.

The appointments of the kitchen in the janitor's apartments are unusually handsome and complete, as shown by the accompanying sketches.

The kitchen is spacious and lighted by two windows and as many handsome electroliers.

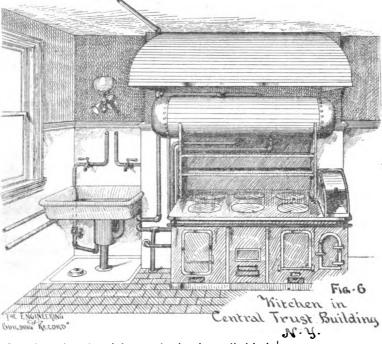
A high wainscot of Italian marble surrounds the room and is surmounted by a molded cap. The walls and ceiling are kalsomined and the window and door trimmings of grained ash. The floor is of dark red tiles, except under the sinks, where marble safes are placed.

The pipes are polished brass, arranged as shown in diagram (Fig. 5, page 329).

The range-boiler (Fig. 6) is made of burnished copper and set horizontally in the extended sides of the range underneath the hood. A galvanized-iron slop-sink is set in a recess beside the chimney, and underneath it is a brass cap closing handhole by which access is had to the wastepipe trap. Fig. 7 shows the butler's tinned copper sink and the three porcelain wash-tubs, with ash tables.

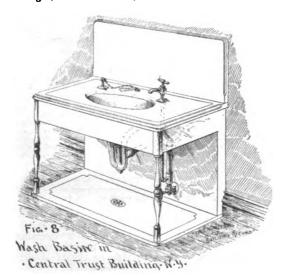
THE Philadelphia Master Plumbers' Association on Thursday, May 10, elected the following delegation to represent them in the National Association meeting:

William M. Wright, William Harkness, Jr., John J. Weaver, Enoch Remick, Albert M. Hicks, William H. Doyle, William McCoach, George Uber, John E. Eyanson, F. P. Brown, A. J. Bond, and as alternate, Wm. S. Clark.



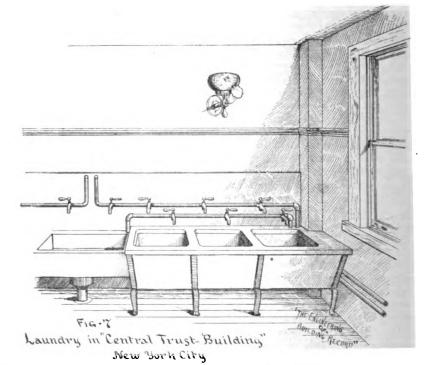
Just above the valve of the supply-pipe is a cylindrical vertical air-chamber (shown underneath, at the right in illustration). A strainer-plate underneath the waste-trap drains any leakage into the drip-pipe under the safe.

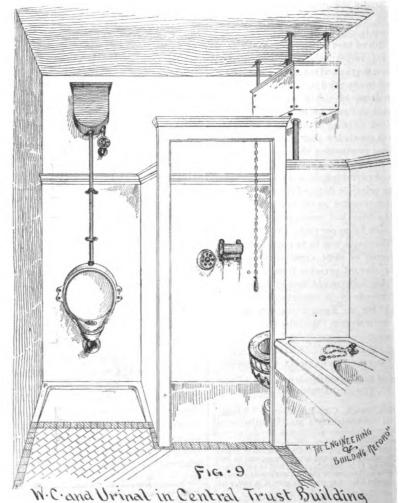
Figure 9 is a sketch of one of two toilet-rooms on the sixth floor, its adjacent companion being entirely similar, but larger, with two closets, etc.



The ceiling and side wall, a small portion of which is shown at the extreme left, are finished in plain white kalsomining; the remaining walls and partitions are of Italian marble, with molded cap of the same. No wood-work appears except the oak door and casing (the former a half-length screen, removed in sketch to show interior of closet), and the cherry closet seat and back. The com-

*In article No. II. of this series the valves L referred to are next the barrel A, and the lowest valves on the pipes F F, etc. In the text the letters K and L are accidentally transposed; to correct it read K wherever L is printed, and vice versa.





New York City
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PLANT OF THE BOSTON HEATING COMPANY. No. IV

(Continued from page 341.) HOUSE-CONNECTION COUPLINGS.

BEFORE passing to the house-connections between the main and the buildings, allow me to call your attention to the special screw-thread which we have used in making the joints in the street with the twofold object of securing extra strength and greater tightness.

Ordinarily, a screw-thread, as is well known, reduces the strength of the pipe or rod on which it is cut about thirty per cent. In Fig. 9 the special thread used in our plant is exemplified. The coupling joining the ends of the pipes B and C is made considerably longer than is customary in ordinary pipe fittings. For a little ways the end of the coupling is bored out so as to be a fairly accurate fit on the end of the pipe. This greatly improves the joint, as the overlapping end of the coupling tends to strengthen and support the pipe that is introduced into it.

The special peculiarity of the thread to which I wish to call your attention, however, is that portion between the points b b' and c c'. It will be seen that the top of the thread is in a straight line with the outside of the pipe, while the bottom of the thread between the points b b' and c c' is inclined to the axis of the pipe at a considerable angle, so as to cause it to run out or vanish at b' or c'. By this means the weakening of the pipe caused by the cutting of the thread is spread out and diffused over a considerable length; and, by proportioning this vanishing of the thread in a proper manner, experiment has shown that it has been possible to preserve 97 per cent. of the full strength of the pipe. In addition, this vanishing of the thread produces a long and very tapering cone which may be forced into the coupling by means of the pipe-tongs in such a way as to actually bed the metal of the pipe into that of the surrounding coupling and make a joint which is absolutely tight. This same result is attained in a less degree with the ordinary pipe thread; but, inasmuch as the cone produced by our special thread is a very much smaller angle than that used by standard pipe-fittings, the pressure of the tongs in making up the joint causes it to bed more firmly into the metal of the coupling. The rolling mill supplies pipe in lengths of about twenty feet, so that the necessity of securing a perfectly tight connection between each length is very apparent. With this form of thread our experience has demonstrated that, even under 1,500 pounds, it is perfectly possible to secure absolutely tight joints. In testing the sections we have never found a leak when the joints were properly made up.

Each coupling also forms an opportunity for a house connection. On either side of the coupling a boss is cast. For the house supply inch pipe is used, and for the return 2-inch pipe, which extends from the main to the sidewalk on either side of the street, passing through a box made of creosoted yellow pine. At the sidewalk a servicebox, Fig. 11, is situated. The supply pipe may be seen at c', while the return pipe is indicated at d'. These pipes, A and B, enter the box and there terminate in a three-way tee provided with asbestos cocks, by means of which the supply from either branch of the tee can be at pleasure controlled. By means of this three-way tee and its asbestos cocks, each service-box is enabled to supply three houses. From the service-box to the inside of the house wall—usually a distance of not more than eight feet copper pipe is employed in preference to iron pipe. The advantage of copper pipe in this location is very obvious when it is considered that, owing to the ductility of this metal, the pipe can be bent in any desired shape without the necessity of special fittings involving the construction and maintenance of a large number of joints.

The size which we most frequently use is 1/4-inch, which is amply sufficient to supply ordinary buildings. In the case of large stores or warehouses $\frac{1}{4}$ or $\frac{1}{4}$ inch is employed. While, where it is desired to supply power to an engine of 25 or more horse-power, $\frac{1}{4}$ or $\frac{1}{4}$ -inch pipe is employed. A 1-inch pipe would be ample to supply so large a building as the Post Office. All of this copper pipe is tested to over 6,000 pounds.

(To be continued,)

A MOVEMENT for the establishment of a Builders' Exchange in Wilmington, Del., has been on foot for some time, and on May 2 a delegation of the Philadelphia Exchange, on invitation, visited that city and held a conference with a number of the builders of that city, and the result indicates there will shortly be an Exchange established there similar to the one now in operation in Philadelphia.

CAUSE OF WATER-BACK EXPLOSIONS.

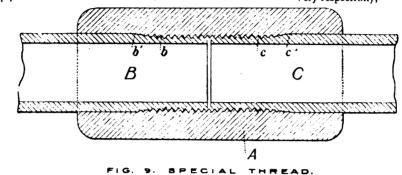
NEW YORK, May 14, 1888.

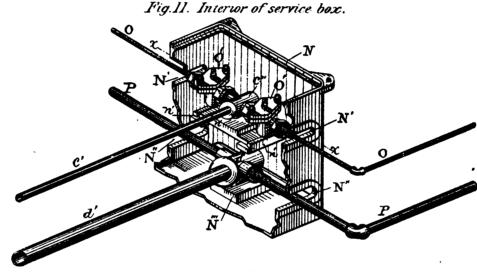
SIR: In your issue of May 12 I notice an article in reference to boiler explosions, cause of same, and how to guard against them, etc., quoted from the Locomotive. Whoever wrote the article can learn a little more on the subject, as I will take the liberty of pointing out a great error which might in future cause as sad a catastrophe as the one in

He suggests on entering a cold kitchen to open hotwater faucet; if water runs through same all is right. This is a mistake, as you will readily see, as you are under those circumstances liable to an explosion if even water runs through hot faucet. I have met several similar instances during my experience where explosions would have taken place were the connections of wrought-iron pipe, as in the foregoing instance. Fortunately, for many persons, the connections generally will not resist pressure to the extent of the one alluded to. As a general rule in this city the connecting pipes with water-back are lead, soldered to

brass couplings on water-back, often not the heaviest lead either, which also is fortunate on many occasions. Now, to get to my point, water may run through hot-water faucet, and the connections between range and boiler may be frozen; when such is the case you will have an explosion shortly after fire is lighted if the lead pipes referred to don't melt or burst, as all communication for expansion

I have thought over this matter many times, and must say it is fortunate there are not more accidents than we have. You will see, in order to avoid same, that it is have. You will see, in order to avoid same, that it is necessary to advise through your valuable paper that it is necessary for all owners or proprietors of houses where they have ranges with water-backs or pipes in them to see that their piping, etc., is kept warm, should it be necessary to keep fire up all night to do so. The proper thing to do is to have their kitchens and cellars underneath same protected so as pipes with not freeze. As a rule I find that protected so as pipes will not freeze. As a rule I find that where such accidents occur are cheap houses or carelessness on part of the occupant or owner in some instances. Very respectfully, JOHN RENEHAN.





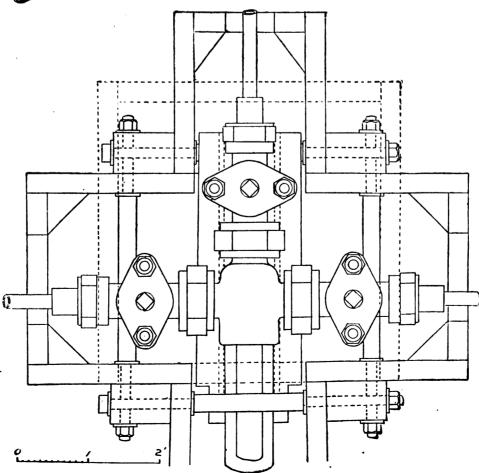


FIGURE 10. PLAN OF SERVICE BOX

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TWENTY YEARS' EXPERIENCE IN STEEL-MAKING.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

THE Engineers' Society of Western Pennsylvania held their regular monthly meeting May 15. Mr. George W. Kettridge was elected to membership. The paper of the evening was read by Mr. Koch, the present Superintendent of the Spang Steel and Iron Co., of Pittsburg. The subject was "Twenty Years' Experience in Steel Making." The paper was a record of actual experience. He was for a number of years connected with the steel works at Landore in South Wales. He first narrated the difficulties Landore in South Wales. He first narrated the difficulties encountered in the making of open-hearth steel, such as the proper bottom of furnace, the proper material for the lining, the proper style of furnace, the repairs necessary, etc. He stated that whereas it was now possible to obtain 500 to 600 heats from a furnace without repairs, in the "good old days" they were satisfied if six could be obtained without the need of repairs to the furnace. Then there was the difficulty in obtaining proper materials; that whereas in the one case of ferro-managanese, it was that whereas in the one case of ferro-manganese, it was now possible to obtain an 80 per cent. metal, then they were satisfied with 22 per cent. That after many experiments their first success with the open-hearth process was when they made their mixture two-third pig and one-third Scrap and then "finishing" with ore.

He then went on to describe their first great success in

the changing of iron rails into steel, the mixture consisting of three tons of pig iron (hematite) and 4½ tons of iron rails. The rails analyzed .20 to .25 per cent. carbon, sulphur about .16 per cent., phosphorus up to .25 per cent., and manganese .125 per cent. These rails were made as heavy as 90 pounds per yard and to the ordinary lengths

Mr. Koch then went on to describe the other articles manufactured at the works at I andore, such as axles, ties, weldless rings, gun-barrels, forgings, shapes for vessels, boiler and ship plates of all descriptions. He gave the average analysis of each of the several articles, mentioning in particular that in the matter of axles the English specifications called for a much higher steel (in carbon) than the American, while in tires the reverse was the case. He also went very fully into the tests required for forgings, shapes and plates. He said that the most interesting part of his whole experience to him had been in the manufactory. ture of plates, and he described the different modes of producing—that is, either from the hammered slab, by cogging or by rolling direct from the ingot. He stated the first two methods were more generally employed in England, while the latter was the one most in use in this country. From his own experience in all three he believed the American method the best adapted for producing the better grade of plates and claimed that under this process, right in Pittsburg, just as fine and as good steel is being made as any place in the world.

He drew a comparison between the plates made under

the three processes above mentioned, taking as his basis the three processes above mentioned, taking as fits basis %-inch plates, carbon .14 to .21 per cent. Under the Eng-lish process the steel divides, as it were, from .14 to .19 carbon, running in tensile strength from 60,000 to 65,000 pounds, with an elongation of 25 to 33 per cent. in eight inches. From 19 to 21 per cent, the steel runs to 70,000 pounds, with 22 per cent, elongation.

pounds, with 22 per cent. elongation.

In this country under our practice steel of .14 carbon will not run over 60,000 pounds, with 28 to 30 per cent. elongation and 55 to 60 per cent. reduction of area. Steel .17 to .18 carbon will run from 58,000 to 65,000 pounds, with 25 to 28 per cent. elongation, while steel .20 to .21 per cent. carbon will run 62,000 to 67,000 pounds in ultimate, with 26 to 27 per cent. elongation, and he asked that the matter be discussed to ascertain how this difference occurred.

asked that the matter be discussed to ascertain now this difference occurred.

He also gave interesting figures relative to quenching tests of steel used by the English Government with and without annealing. He believed the process of rolling direct from the ingot on a three-high mill the correct one, and stated that he had actually been asked by a large English manufacturer to have him sent drawings of such

Captain Hunt stated that in the matter of analyses his experience largely agreed with that of Mr. Koch. In answer to his question as to the difference between the English and American steels he thought that the finishing of the plates and the heat at which they were rolled might account for it to some extent, and, secondly, that, as is well known, the hammering of slabs has the effect of hardening steel, and as the English process is largely hammering

this would account for it.

Further discussion of the paper was postponed until the next meeting, when, having been printed and the figures being before the society, the paper could be acted upon more intelligently.

Mr. Brashear presented to the society some samples of aluminum (containing 08 per cent. of the pure metal) and Mr. Metcalf gave a brief description of the process of making the alloy of aluminum, after which the society

A CORRECTION.

In the notice in our last issue of the report of the City Engineer of Boston attention is called to the ravages of the Limnoria terebrans as far north as Boston. It would have been about correct to have said south, for Cape Cod is usually considered to be the southern limit of the habitat if the Limnoria, although traces of its presence have been found in New York Harbor. THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE attendance at the Nashville meeting of this society, convened on May 8, was smaller than at any meeting which has been held for some time. The membership in the South is as yet small, and the distance and time required to make the trip had a tendency to keep Northern and Eastern members at home.

The society was well received, being welcomed to Tennessee by Governor Taylor, and to Nashville by Mayor

The society was well received, being welcomed to Tennessee by Governor Taylor, and to Nashville by Mayor McCarver, and every opportunity was offered to see the institutions and places of interest.

The society was called to order by President Horace See, of Philadelphia, Professor F. R. Hutton, of Columbia College, Secretary.

The members present were:

E. S. Cobb, Terre Haute, Ind.; A. T. Woods, Champaign, Ill.; H. G. Hammett, Troy, N. Y.; Peter H. Kirkvaog, Youngstown, O.; P. J. Fickinger, Beaver Falls, Pa.; William A. Foster, Corning, N. Y.; Horace B. Gale, St. Louis; C. M. Woodward, St. Louis; T. H. Stillman, New York City; Joseph Lem Gabrille, Cleveland; Edward S. Dent, Washington; Charles W. Livermore, New York; John C. O'Connell, Montgomery, Ala.; William Watson, Boston, Mass; Henry H. Suplee, Philadelphia; S. Tompkins, Crozet, Va.; John W. Weston, Chicago, Ill.; Henry J. Snell, Philadelphia; W. R. Warner, Cleveland, Ohio; E. H. Parks, G. E. Whitehead, Providence, R. I.; S. Ashton Hand, Toughkenamon; F. F. Hennaway, H. B. Parsons, Lewis C. Dawes, New York; O. A. Lanphear, H. P. Minott, Columbus, O.; Jacob Reese, Pittsburg; George M. Bond, Hartford; George R. Stetson, New Bedford, Mass.; B. H. Warren, Boston; John E. Sweet, Syracuse; Joe F. Fireston, J. Wendell Cole, Columbus, O.; S. W. Baldwin, New York; Frank E. Kirby, W. S. Rayner, Cincinnati; John F. Wilcox, Pittsburg; George H. Barrus, Boston; Joel Sharp, Salem, O.; William T. Magruder, Vanderbilt; William Miller, Pittsburg; Samuel A. Parker, Massachusetts; Alfred Pritt, Washington, Del.; William Kent, New York; T. H. Roberts, Detroit.

The secretary reported that there were received during the past year 45 members, 2 associates, and 11 junior

New York; T. H. Roberts, Detroit.

The secretary reported that there were received during the past year 45 members, 2 associates, and 11 junior members, making a total membership of 858.

The following papers were read: On "Heating Railway Cars by Steam From the Locomotive," Henry R. Towne, of Stratford, Conn., and "Notes on Warming Railroad Cars by Steam," by W. J. Baldwin, of New York, given in our issue of May 12.

John T. Hawkins, of Taunton, Mass., read a paper on steam-heating apparatus for buildings, and another entitled

John 1. Hawkins, of Taunton, Mass., read a paper on steam-heating apparatus for buildings, and another entitled "A Plea for the Printing Press in Mechanical Engineering Schools." Mr. George L. Fowler submitted a paper on "Estimating the Cost of Foundry Work," and Mr. H. L. Binsse one on "A Short Way to Keep Time and Cost."

The following questions were discussed: "What is the most economical speed of cable in tele-dynamic trans-

The following questions were discussed: "What is the most economical speed of cable in tele-dynamic transmissions for high and low power?" Second, "What data have you for design of hemp-rope transmissions especially where several parallel ropes replace a flat belt?"

In the afternoon the party took a run on the railroad in special coaches to Fisk University, and inspected the grounds and buildings. Jubilee songs were rendered by the students in fine style and were loudly applauded. The party then proceeded to West Nashville and visited the new furnaces of the Standard Charcoal, Iron and Chemical Company.

Company.

The evening session was well attended by both ladies and gentlemen. Upon the stage were seated Governor Taylor, Mayor McCarver, Professor Woodward, of St. Louis; Chancellor Garland, of Vanderbilt; General Thurston, Judge Reese, President See, and Secretary

General Thurston introduced Governor Taylor, who delivered an address of welcome to the visiting society.

Mayor McCarver was then introduced and addressed the

On behalf of the association President See returned its thanks to the speakers for their welcome.

Professor C. M. Woodward, of St. Louis, the speaker

of the occasion, was introduced by Mr. See and addressed the audience on the "Coming Engineer." At the conclusion of the address a brief reception was

At the following morning session a large number of

papers were read and discussed with interest.

The session adjourned at 12 o'clock and again assembled

(informally) at 1:30 P. M. and went in a body to pay their respects to Mrs. James K. Polk. They then proceeded to Glendale Park.

A stop was made at the new reservoir, which was very thoroughly investigated, after which refreshments were

The train next stopped opposite the residence of Dr. H. M. Pierce, where the ladies of the train boarded it. Mrs. H. M. Pierce and daughter had very kindly and hospitably entertained the visiting ladies of the society at their resi-

In the evening a number of papers were read and dis-

The convention adjourned to meet in Scranton, Pa., early in October next

F. W. Dean presented a paper on "The Distribution of Steam in the Strong Locomotive," in which he made comparisons unfavorable to the Stevenson link, and practically condemned the use of balanced valves. Discussed y Messrs. Barrus and Coon.
In discussing John T. Hawkins' paper, "A Plea for

the Printing Press in Mechanical Engineering Schools," Professor Sweet told the members who had been iscussing why the printing press did not find room in technical schools, and those who had been listening to these discussions, that while he was at Cornell University they had one large and two small presses, and studied and used them to advantage, but since that time they had been thrown out. thrown out.

Mr. Hawkins also presented another paper relating to heating by hot water, in discussing which the curicus fact appeared to be brought out that nine-tenths of the heating in Montreal, where the climate is very severe, is cone by hot water, and about three-fourths of the heating it Washington, where the climate is very mild.

In discussing the paper presented by L. S. Raudolph, on "Strains in Locomotive Boilers," Mr. Middl:ton, of the Louisville and Nashville Railroad, said that th: use of the Belpaire boiler did away, to a large extent, vith the breaking of stay-bolts.

In discussing the paper, "The Effect of Circulation in Steam-Boilers on the Quality of the Steam," Mr. Whitaker instanced a case of priming of the boilers of the U.S. steamship "Galena." The priming in this case was stopped by removing some of the tubes under the smoke-

Stopped by removing some of the tubes under the Sinoke-stack and substituting bolts.

During the discussion of a paper on "Origin and Nature of the Surface Condenser," Secretary Hutton exhibited some brass tubes used for condensing the vapors in reining sugar, which appeared to show that the vapors had destroyed the zinc in the metal, eating the tubes entirely through in spots.

Gas and Electricity.

Illuminating Power of Gas in New York City.

1								
	Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas Light Company
ı							'	
	Мау 12	25.90	20.65	22.71	30.88	20 95	26.11	32.30

THE PITTSBURG ALUMNI ASSOCIATION OF THE RENSSELAER POLYTECHNIC INSTITUTE.

ABOUT 50 graduates of the Rensselaer Polytechnic Institute live in or near Pittsburg, of whom some 20 met in that city on the 11th inst. and organized the above-named association.

Edmund Vardley was elected President: William Metcalf. F. L. Clark, F. C. Osborn, and I. V. W. Rynders. Vice-Presidents; G. S. Davison, Secretary; and A. B. Starr, Treasurer,

The following gentlemen joined the association: Edmund Vardley, class of '56; A. B. Starr, '69; George S. Davison, '78; W. G. Wilkins, '79; F. C. Osborn, '30; F. L. Clark, '80; G. W. Ferris, '80; H. W. Verner, '81; C. H. Davis, '83; H. M. Wilson, '84; James Wetzel. '85; A. C. Cunningham, '85; S. L. Tone, '86; J. V. W. Rynders, '86; P. H. Easley, '86; Stewart Johnston, '87; Thomas Earle, '87, and J. D. Hailman, '87.

It was resolved to invite the general Alumni Association to hold their annual banquet and meeting next winter in Pittsburg, instead of in New York, as heretofore.

PUBLICATIONS RECEIVED.

PRACTICAL HINTS FOR DRAUGHTSMEN. By Charles William MacCord, A. M., Sc. D., Professor of Mechanical Drawing in the Stevens Institute of Technology. New York: John Wiley & Sons. 1888. Cloth, 100 pp., 9/4x11/4 in. \$2.50.

THE DESIGNING AND CONSTRUCTION OF STORAGE RESERVOIRS. By Arthur Jacob, B. A., late Executive Engineer for Irrigation, H. M. Bombay Service. Revised and Extended by E. Sherman Gould, M. Am. Soc. C. E. 137 pp. With Illustrations. New York: D. Van Nostiand. 1888.

STEAM-HEATING: An Exposition of the American Practice of Warming Buildings by Steam. By Robert Briggs, M. Inst. C.E. With an addendum by Alfred R Wolff, M. b. 122 pp With Illustrations. New York: D. Van Nostrand. 1888.

THE TESTING OF MATERIALS OF CONSTRUCTION By Wilham Cawthorne Unwin, F. R. S., M. Inst. C. E. 488 pp. 8vo. With illustrations. London and New York: Longmans, Green & Co. 1888.

TENTH ANNUAL REPORT OF THE WATER DEPARTMENT OF THE CITY OF BRIDGETON, N. J., for the year 1887. 14 pp., 8vo. Bridgeton, N. J. John Cheesman, Printer. 1888.

PERSONAL.

Dr. Henry Mitchell, of Asbury Park, N. J., who has been active in promoting the sanitary welfare of that community, has retired from the local Board of Health. complimentary resolutions on his retirement having been adopted by the board.

GEN. H. L. ABBOTT, U. S. A., Engineer Corps, is now in charge of the office and public property of the late Gen. Q. A. Gillmore.

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CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

COUNCIL BLUFFS, lowA.—School.—Plans are wanted by the Board of Education for a \$40,000 public school edifice. No date specified. For circular of instruc-tions address the Public School Board, as above.

BOSTON, MASS.—Messrs. Longfellow, Alden & Har-ow, architects, of this city, have won the competition low, architects, of this city, nator the Cambridge City Hall.

MILWAUKER, Wis.—Temple. - Plans are wanted here, until June to, for a temple, by the Board of Construction of the Wisconsin Consistory. For circu'ar of instructions, etc., address David C. Green, Secretary of the Board, Room 69, New Insurance Building, as above.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-viii-356

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

GRAND JUNCTION, COL.—Water.—C. W. Baldwin, Town Recorder, writes from here as follows: "The town has just voted a franchise to Krusen & Co. for water-works (pumping-works), taking water from Gunnison River. It is understood that the works are to be put in immediately, to cost about \$60,000."

PARIS, Ky.—Sewerage.—C. F. Levy, Town Clerk here, writes: "As yet no steps have been taken in re-gard to sewerage."

LEOTI, KAN.—Water.—Owen Clark, City Clerk, writes us from this place, May 7, as follows: "The only step taken at present is a call for a board election and our water-works depend entirely on the result of this election, which we think favorable."

BIR MINGHAM, ALA.—Water.—The following communication from J. S. Walker, Mem. Am. Soc. C. E., engineer in charge at the Birmingham Water-Works, turnishes interesting details concerning the water-works project here: "The Birmingham (Ala.) Water-Works Company is making surveys for an additional supply to be taken from the Cahaba River. The pumping station will be located on the Cahaba River. The pumping station will be located on the Cahaba River, and the water will have to be pumped over 400 feet. There will be about 30,000 feet of 30-inch pipe and 8,300 feet of 24-inch pipe. Two mountain ranges will be crossed, on one of which will be located a reservoir of 100,000,000 gallons capacity; the other range will be tunneled for a distance of about 2,300 feet. The tunnel, pipe, valves, specials, and pumping machinery will be let by contract, the rest of the work will be done by company force. It is expected to begin work as soon as surveys are completed. When location and plans are perfected more definite information will be given. Major W. J. Milner is superintendent."

TOLEDO, O.—Sewers.—A cylindrical brick sewer is to be constructed here, also several hundred feet of brick sewers. See our Proposal Columns for details.

ST. LOUIS, Mo.—Water.—Several thousand feet of water—pipe will be laid here at once, a new boiler house to be erected, and other improvements will take place. Complete information in our Proposal Columns.

WHITESTONE, L. I.—Water.—It is probable that conclusive steps will soon be taken in the water-works project which has been agitated here for some time.

DETROIT, MICH.—Water.—Iron water-pipes are to be laid through numerous streets of the city which have heretofore been without the water supply.

SIDNEY, O.—Water.—Our correspondent writes:
"Mr. George Hornung of Cincinnati, O., has been engaged as Consulting Engineer by the Water-Works Trustees of this place for the extension of their works, and is now engaged upon the plans, specifications, etc., of the work, comprising a power house with duplicate set of machinery, stand pipe, and a mechanical filtering plant. Proposals for constructing the work will shortly be solicited.

BURLINGTON, VT.—Water.—At a meeting of the city officials, held May 8, it was decided to construct at once a reservoir to cost \$25,000, and the City Council received authority to borrow the amount of money required to do the work. For details address City Clerk Allen.

BAKER CITY. ORE.—Water.—It is reported that water-works are contemplated at this place.

WALDOBORO, ME.—Water.—An appropriation for the construction of a system of water-works has been made, and it is probable that a plant will soon be established.

BARRINGTON, R. I.—Water.—The Drownville Water Company has been organized here with a capital stock of \$10,000. William Lawler is at its head.

LONOKE, ARK.—Water.—It is reported that the Mayor can furnish details of a proposed water-works system for this place.

BOOTHBAY, Mr.—Water.—It is reported that water-

ABILENE, TEX.—Water.—It is reported that the ater-works here are to undergo extensive improve-

ST. PETER, MINN.—Water.—The city has voted to ssue bonds for \$32,000 to construct a system of water-

GALLITZIN, PA.—Water.—It is reported that details of an extensive pipe-laying project can be had by addressing Thomas Bradley, of the Tunnel Hill Water Co., at this place.

ASHLAND, Wis.—Sewers.—The sewerage system of this city is to be extended at once.

NEW ROCHELLE, N. Y.—Governor Hill, of New York, has signed the bills giving the State Board of Health power to stop the Mount Vernon sewage dischalge into East Chester Creek in case such discharge shall constitute a public nuisance, and providing for the construction of a system of sewerage at this place

LITLE VALLEY, N. Y.—Water.—Town Clerk S. F.
Sweetland writes from here as follows: "We recently
voted in this village to expend a sum not exceeding
\$15,000. We are to have spring water brought 2½
miles in a 4-inch wrought-iron pipe to a 15,000-barrel
reservoir, 175 feet above our village. From this we are
to have a six-inch pipe. The spring is 300 feet above
our village. Work will begin on the trenches the 21st
inst."

NEW YORK CITY.—Water.—The Department of Public Charities and Correction of this city advertises for a quantity of cast-iron water-pipe, also sewer pipe and other supplies and furnishings. For details see our Proposal Columns.

MT. VERNON, N. Y.—Sewers.—In view of the \$150, 000 appropriation for a sewerage system for this place the Village Trustees at a recent meeting employed C. S. McClelland to purchase the necessary right of way along the proposed route, and put the engiteering work in charge of W. E. Worthen, of New York City.

EAGLESMERE, PA.—Sewers.—The Eaglesmere Drainage and Sewerage Association has been organized here for the purpose of providing a complete system of drainage, sewerage, etc., for the town. Arrangements are to be made at once for pushing the work. The president of the above can furnish details.

MONONGAHELA CITY, PA.—Water.—Work is shortly to be commenced on the water-works system for this place, and bids will soon be wanted for the completion of the same. For details address S. H. Fox, Secretary of the Kittanning Consolidated Natural Gas Co., Kittanning, Pa.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works material at the following places: Meyersdale Pa., Eureka, Kan., Brooklyn, N. Y., New York City, St. Louis, Mo., Toledo, Ohio, Cedar Falls, Iowa.

BRIDGES.

LEAVENWORTH, KAN.—County Clerk Niehaus, at this place, advertises for proposals for the erection of several bridges. For details see our Proposal Columns.

INDEPENDENCE, Mo.—An iron bridge is to be erected over Little Blue River at this place. For details see our Proposal Columns.

ST. PAUL, MINN.—At the recent city election bonds to the amount of \$200,000 were voted to build a bridge across the Mississippi at Broadway. Bonds will be across the Mississued at once.

SMYDERTOWN, PA.—It is reported that a bridge is to be erected here by the County Commissioners and that John B. Wagner can furnish details.

SUDBURY, PA.—It is reported that the County Commissioners will erect a bridge here.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Bradford, Pa., Leavenworth, Kan.

RAILROADS, CANALS, ETC.

VICTORIA, TEX.—It is probable that a street railroad will be built here as soon as details can be arranged. For information address C. L. Thurmond, as above.

HAWKINSVILLE, GA.—A street railway is to be established here by the Hawkinsville and Waycross R. R. Co.

BEATRICE, NEB.—The Union Pacific Railway Co. has awarded the contract for the construction of its line between Plainville, Rooks Co., and Colby, Thomas Co., Kan., a distance of 110 miles, to Kilpatrick Bros. and Collins of this place.

STREET-WORK AND PAVING.

St. Louis, Mo.—The Aldermen of this city want proposals for furnishing a large quantity of macadam, also for doing street work. See our Proposal Columns

HUNTSVILLE, Mo.—Several miles of rock roads are to be made here this summer.

SIOUX FALLS, DAK.—Many of the principal avenues of this place are to be paved at once.

FLUSHING, L. I.—The trustees of this place have been authorized to expend the sum of \$20,000 in improving the public streets, by macadamizing and otherwise.

ASHLAND, WIS.—City Engineer Carrington has submitted his estimate of timber to be used in planking new streets to be graded, it being 2,632,570 feet.

HAMILTON, ONT.—Several streets of this place are be repaved and other street improvements will be

GAS AND ELECTRIC-LIGHTING.

EASTHAMPTON, MASS.—The Easthampton Electric Company has been incorporated here with a capital of \$10,000. J. E. Clark, and others, incorporators.

MIDDLETON, MASS.—It is reported that an electric light plant is to be established here.

MORRISTOWN, N. J.—It is probable that an electric-light plant will be established here.

SCHENECTADY, N. Y.—The Common Council of this city has passed resolutions ordering the Committee on Lamps to advertise for proposals for lighting the city with electric arc-lights by means of 2,000 candle-power lamps, etc., according to specifications. For details see our Proposal Columns.

OCALA, FLA.—A gas company has been organized and a \$20,000 plant is to be established. Address Fred. H. Brown, Blue Springs, Fla., for details.

Boston, Mass.—The Boston Gas Light Company is offered to light all the street lamps in the city oper for \$1 per 1,000 cubic feet of gas.

ASHLAND. WIS.—The Ashland Lighting Co., Edwin Ellis, President, will expend the sum of \$8,000 on improvements this summer.

JACKSONVILLE, FLA.—This city advertises for pro-posals for lighting its public streets, etc., by electricity For complete details see our Proposal Columns.

BIDS OPENED.

CAMDEN, N. J.—Stand-Pipe.—The Water Committee of City Council opened the following bids May of the new stand-pipe to be erected at the Pavonia Basin: Jacob H. Yocum. \$6,311; John Braizley, \$6,665; Charles F. Hollingshead, \$6,000; R. D. Wood & Co., \$5,780. The contract was awarded to the lowest bidder.

ST. PAUL, MINN.—Sewers.—The Board of Public Works has awarded contract for sewers on Congress Street and Clinton Avenue to Stockton & Lindquist for \$6,250.

ST. PAUL, MINN.—Elevators.—The Court-House commission has awarded the contract for the two elevators to be placed in the new Court-House to the McAdams & Cartwright Company, of New York, for 38,500. The contract for iron vault doors and windows was awarded to the Diebold Safe and Lock Company for \$97 for windows and \$107 for doors.

NEW YORK CITY.—Aqueduct.—At a meeting of the Aqueduct Commissioners held May 16 the contract for the construction of the pipe-line from 13th Street and Convent Avenue to the Central Park Reservoir was awarded to O'Brien & Clark, the lowest bidders, their figure being \$1,030,215.

MILWAUKEE, WIS.—Addition.—The following pro-posals for building an addition to the Eighth Ward school were opened May 8: Joseph Conrad, \$7,400; John Horn, \$7,400; Joseph H. Liencheek, \$7,200. The sat-named budder received the contract. The contract or the plumbing was awarded to E. T. Doyn for ocnool were John Horn.

MILWAUKEE, Wis.—Syphon Pipe.—The following proposals for furnishing a wrought-iron syphon pipe for the Menomonee intercepting sewers were opened May 8: Logeman & Giesler, \$2,000; Richard Davis, \$1,800; F. Weinhagen, \$1,771. The contract was awarded to the last named bidder.

PHILADBLPHIA, PA.—Bridge.—Bids were opened by the Department of Public Works for the construction of a bridge over Sixth Street across the Connecting R. R. The only bidder was W. H. Brown, at \$12,500.

BROOKLYN, N. Y.—Iron Work.—The New York and Brooklyn Bridge Trustees have awarded the contract for extending the car platform from Nassau and Concord Streets in Brooklyn to the Passaic Rolling Mill Company for the sum of \$50,120. The contract for the iron work to be used on the Barnes-Martin extension of the bridge has been awarded to the New Jersey Steel and Iron Works for \$25,000.

BOSTON, MASS.—Tower.—The only proposal for building a wooden tower around the iron high-service tank on Mount Bellevue was from R. R. Mayers & Co., at \$7,375. As that bid was in excess of the estimated cost the Water Board concluded to advertise again.

cost the Water Board concluded to advertise again.

Boston, Mass.—Stone.—The City Architect received the following proposals for freestone for a grammar school house at South Boston: W. J. Sullivan, 44,950; Jeremiah Carew, \$4,883; awarded to Mr. Carew. For the cut granite required on the same building the bids were M. J. Donahet, \$2,049; Pigeon Hill Granite Co., \$2,157; Milford Pink Granite Co., \$2,342; Robert McLaughlin, \$1,075; Rockport Granite Co., \$1,524; E. Richer & Son, \$1,724; John Joyce, \$1,665; Granite Railway Co., \$2,100; awarded to Rockport Granite Co.

MINNEAPOLIS, MINN.—Temple.—Contract for the rection of the Masonic Temple has been let to T. A. Fisher. The total cost of the building will be \$150,—

MILWAUKEE, WIS.—Bridge.—The following proposals for building a bridge in Juneau Park were opened May 8: F. Weinhagen, \$1,800; Milwaukee Bridge and Iron Works, \$1,485. The contract was awarded to the last named bidder.

last named bidder.

Norwalk, Conn.—Sewer Construction.—The following proposals for sewer construction were opened May 7 by C. N. Wood, Engineer: Brady Bros., Bayonne, N. J., \$34,651.22; J. S. Bogert & Co., Brooklyn, N. Y., \$45,688.70; M. O'Neil, Hartford, Conn., \$47,256.64; Hains & Maguire, Brooklyn, N. Y., \$48,960.14; E. W. Everson, Yonkers, N. Y., \$40,153.75; E. McManus, Waterbury, Conn., \$41,391.65. Contract awarded to Brady Bros.

WILLIMANTIC, CONN.— Sewer Construction.—The following proposals for sewer construction were opened May 14 by the Special Sewer Committee: Jacoby & Maddin, Bridgeport, Conn., \$12,188.90; A. Brazor & Son, Middletown, Conn.. \$15,489.70; Robert Fenton, Windham, Conn.. \$10,336.60; Edward McManus, Waterbury, Conn., \$12,872.10; Thomas C. Davis, Allston, Mass., \$12,464 21; F. B. Durfey, Norwich, Conn., \$9,445.04. Contract awarded to F. B. Durfey.

GOVERNMENT WORK.

FORT CITY, KAN.—Water-works.—The following bids for constructing a system of water-works were opened May 9 by Capt. George E. Pond, Assistant Quartermaster, U. S. A.: John Dwyer and G. W.

Peaisons, Kansas City, Mo., well and connections, two bids, \$2,050 and \$3,400; engine-house, pump-pit. and reservoir, \$11,148; machinery, \$8,543; pipe system, \$22,078; total, \$44,728 and \$44,650 (not Deane pump). Cook & Heaton, Junction City, Kan., total bid, \$44,-450 (Deane pump). Francis H. Smith, New York, total bid, \$54,000 (Blake pump). Bids for hydrants, valves, machinery, etc., were also received, but as they were not complete they were not entertained. The contract will be awarded by the Quartermaster-General of the Army.

WASHINGTON, D. C.—Navy Yaid Supplies.—The following proposals for furnishing supplies for the Norfolk Navy Yard were opened May 8 by James Fulton, Paymaster General, U. S. Navy Department. The specifications called for the following named quantities.

A, 150 tons steel, 50 pounds to the vard; B, 1,500 steel angle-plates; C. 3,200 track bolts; D, 10,500 pounds track stakes; E, 5 split-steel switches; F, 5 steel frogs; G, 5 ground lever switch-stands; H, 5,700 creosoted yellow pine railroad ties; I, railroad tools; K, yellow pine lumber for engine-house; L, 1,000 tons anthractte broken coal; M, 1 rail bending and straightening machine. Supplies for Boston Navy Yard—N, 23,806 pounds domestic wire rigging.

The following are the bidders and their respective amounts:

The following are the bidders and their respective amounts:

I. W. Gaskell & Sons, Philadelphia—A. \$39 per ton; B, 3c. per pound; C, 3½c. per pound; D, \$2.50 per 100 pounds; E, \$33 cach; F, 3 No. 8, \$23 cach; 2 No. 6, \$20 cach; G, \$4.60 cach; H, \$5,013; I, \$256; K, \$511.76; M, \$137.

James Symington, New York—A, \$35.50 per ton; B, 2½c. per pound; C, 3½c. per pound, accepte; D, \$2.25 per 100 pounds, accepted; E, \$36.50 cach; F, No. 8, \$20; No. 6, \$25; G, \$3.05.

Thomas C. Gill & Co., Philadelphia, A, \$36.45 per ton; B, \$2.20 per 100 pounds, accepted; C, 43 10c. per pound; D, \$2.20 per 100 pounds, E, \$37 ca; F, No. 8, \$26; No. 6, \$24; G, \$7 ca; M, \$40.

Rowland A. Robbins, N. Y. City, A, \$34.07 per ton; B, 2 07-100c, per pound; C, 3 74-100c, each; D, \$4.20 cach; H, \$4.464 accepted; I, \$195.26; M, \$115.40; N, \$1,295.05.

2 4/3 cach; H, \$4,404 moor.
N. \$1,205.05.
Samuel D. Puller, Norfolk, H, \$4,372.19.
Carolina Oil and Creosote Company, Wilmington,

Carolina Oil and Creosote Company, Wilmington, N. C., \$26.

James W. Soper, N. Y. City, I, \$186.74, accepted.

C. W. & H. W. Middleton, Philadelphia, —, \$38.25
per ton; E, \$34 each; F, No. 8, \$25; No. 6, \$23; G, \$5
each. cn. A. A. McCullogh, Norfolk, Va., H, \$5,347.60; K,

Frank T. Wyckoff, Williamsport, Pa., H, \$6,599.25. Tredegar Company, Richmond, Va., D, 2.3c. per

pound.
Creosote Lumber and Construction Company, Fer nandina, Fla., H, \$5.415.
R. J. Neely & Co., Portsmouth, Va., K, \$512.
Trant & Bro., Portsmouth, Va., H, \$4,503; K

\$617.62. David Duncan & Son, New York, L, \$3.95 per ton,

David Duncan & Son, New York, L, \$3.95 per ton, accepted.

G. W. Taylor & Co., Norfolk, Va., L, \$4.14 per ton.
Lexington, Ky.—Post-Office.—The following proposals for the interior finish of the post-office here, were opened May 15 by the Supervising Architect of the Tressury Department:

John Mitchell, \$23,687 (\$600 additional if finished in oak); Robert Mitchell Furniture Co., \$24,594; George W. Corbett, \$24,000; McCarthy & Baldwin, \$35,535; Robinson Planing Mill Co., \$22,991.

MISCELLANEOUS.

BROCKPORT, N. Y.—The State building at this place is to be refitted with new heating apparatus and plumbing.

sing.

ST. PAUL, Minn.—Much controversy has been excited over the proposition to lower the grade of Selby Avenue, or tunnel under the intersection of Selby and Summit Avenues, in order to lessen the danger of the steep Selby Avenue grade, down which the cable street car line runs. City Engineer Rundlett has made the following exhibit of the cost of lowering the grade:

Estimate No. 1—An 11-foot grade, 24-foot roadway side, to be supported by retaining walls, with bridge at Summit Avenue; cost, \$43,000. Estimate No. 2—An 11-foot grade, 60-foot roadway, with bridge at Summit Avenue; cost, \$43,000.

NEW CORPORATIONS.

THE Garden City Conductor and El Paso Railroad Co., Garden City, Kan. Capital, \$1,000,0000. N. P. Myton, and others, incorporators.

THE Leavenworth Central Rapid Transit Company, Leavenworth, Kan. Capital, \$100,000. Joseph Whit-aker, and others, incorporators.

THE Knox and South Bend Railroad Co., Knox Ind. Capital, \$1,000,000. C. H. Smith, and others, incorporators.

THE Fern Wood and Lake Calumet Street Railway Co., Chicago, Ill. Capital, \$50,000. S. Montgomery Smith, and others, incorporators.

THE Gulf and Chicago Construction Co., Chicago, ll. Capital, \$300,000. C. C. Merrick, and others,

THE San Diego Union Depot and Terminal Railway Co., San Diego, Cal. Capital, \$1,000,000. E. W. Morse, and others, incorporators.

THE Long Beach and San Pedro Railway Co., Los Angeles, Cal. Capital, \$100,000. J. M. Leach, and others, incorporators.

THE Cooperstown and Charlotte Valley Railroad Co., Onconta, N. Y. Capital, \$15,000. Datus E. Silver, and others, incorporators.

THE Sanitary Plumbing Manufacturing Co., Oak-ind, Cal. Capital, \$700,000. William M. Sack, and thers, incorporators.

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PROPOSALS.

(Continued from page viii,)

HOSPITAL, Manchester, N. H.—Proposals are wanted until May 24, for the construction of the Elliott Hospital at the above place. Address Benjamin C. Dean, Chairman of the Executive Committee as above.

IRON RAILING, Boston, Mass.—Proposals are wanted until May 25, for building an iron railing on the sea wall at Charles River embankment: also on iron pier at Marine Park. Address the Board of Park Commissioners, as above.

REBUILDING ENGINE, New York City.—Pro-osals are wanted until May 29, for rebuilding engine, tc., of Steamer "Minnahanonck." Address the Department of Public Charities and Correction, No. 66 etc., of Steamer "Mini-Department of Public Cha Third Avenue, as above.

CITY HALL, Meade Centre, Kan.—Proposals are anted for a city hall. No date specified. Address A. M. Williams, as above.

PI.UMBING, New York City. — Proposals are wanted until May 29 for the new plumbing and repairs to the old plumbing, New York City Asylum for Insane, Ward's Island. Address the Department of Public Charities and Corrections, No. 66 Third Avenue, as above.

GRANITE PAVING BLOCKS, Gloucester, Mass,
—Proposals are wanted until May 21, for laying about
300.000 Boston granite paving blocks on certain
streets. Address John J. Sornes, Clerk, Committee on
Highways, as above.

ELECTRIC LIGHTS, Jacksonville, Fla.—Proposals are wanted until July 1, for electric lights, the plant to be owned and operated by the contractor, the city to take 30 arc lights; works to be in operation by October 1, 1888. Address William Henry, Mayor, as

LAYING WAFER PIPE, Meyersdale, Pa.—I posals are wanted until May 25, for building reserv laying pipe, etc., for furnishing the above place water, according to specifications. Address S. Phieson, Secretary Board of Directors, as above.

PAVING BLOCKS, Augusta, Me.—Proposals are wanted until May 26, for supplying the above city with granite paving blocks, during the year 1888, to pave about 3,700 square yards, according to specifications. Address Committee on Paving, as above.

Building Intelligence.

.WR solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; bs dwell, brown-stone dwelling; apart house, apart nent-house: ten, tenement; e, each e, owner; a, architect; b, builder; fr, frame.

NEW YORK.

7, 9 and 11 Laight and 1, 5 and 7 York, br store; cost, \$71,000; 0, J W Dimick: a, L C Holden; b, J J Lewis. 105-107 Orchard, 2 br flats and stores; cost, \$35,000; o, Fay & Stacom; a, Rentz & Lange.

West, s w cor Bethune, br factory; cost, \$30,000; o, R J Livingston; a, J B Snook & Sons.

253 E 10th, br, stone and terra cotta flat; cost, \$18,-000; o, E Von Au; a, J Hoffman.

40th st, n s, 314 e 1st av, fr shed; cost, \$11,800; o, Equitable Gas Light Co; a, A W P Cramer.

535 W 43d, 5 story ten; cost, \$12,000; o, H Herbert, on premises; a, J W Cole.

53d st, n s, 100 w oth av. 4 br flats and stores; cost. \$18,000 each; o, J Donnellon; a, Thom & Wilson.

Blackwell's Island, br chapel; cost, \$50,000; o, N Y P E Mission Society; a, F C Withers; b, P Hermann's

85th, n s, 200 e Av A, 4 br and stone flats; cost, \$15,-000 each; o, L Schneider; a, E Wenz.

Madison av, e s, bet 70th and 71st, bldg for chapel, museum, etc.; cost, \$70,000; o, the Presbyterian Hospital of New York; a, J C Cady & Co.

Madison av, e s, bet 70th and 71st, br pavilion; cost, 630,000; o, and a, same as last

72d, s e cor oth av, br flats and stores; cost, \$56,000; o, J T Farley; a, Thom & Wilson.

72d, s s, 45 e 9th av, br and stone dwell; cost, \$20,000; o and a, same as last.

85th, s s, and 84th, n s, 175 e oth av, 8 br and stone dwells; cost, \$18,000 each; o, G C Edgar; a, G A Schellenger.

90th, s s, 125 w 8th av, 4 br and stone dwells; cost, \$18,000 each; o, W E Diller; a, G A Schellenger.

86th, s s, 110 e 10th av, br and stone dwells; cost, \$25,000 each; o and a, J G Prague.

86th, n s, 125 e 10th av, 7 br dwells; cost, \$25,000 each; o, D W James; a, same as last.

86th, ne cor oth av and 87th, se cor oth av, 2 br and tone flats and stores; cost, \$53,000; o and a, J G

7th av, s e cor 135th, br flat; cost, \$28,000; o, W Whitehead; a, Berg & Clark.

135th, s s, 75 e 7th av, br flat; cost, \$42.000; o and a, same as last.

234 E 35th, br ten and store; cost, \$8,000; 0, Timothy Harrington; a, D & J Jardine.

N s 130th, 175 e 8th av, 5 br dwells; cost, \$50,000 all; o, Stephen J Wright; a, Cleverdon & Putzel. S s 131st, 175 e 8th av, 5 br dwells; cost, \$50,000; o a id a, as above.

54-56 Henry, 2 br flats; cost, \$35,000 all; o, LSM Cusack; a, Rentz & Lange.

BUILDING INTELLIGENCE.

NEW YORK CITY-Continued

S s 87th, 230 e 5th av, 2 br flats; cost, \$8,000 all; o, James A Frame; a, A B Ogden & Son.

Ne cor 96th and Lexington av. br flats and stores; cost, \$35,000; o, Emeline Johnston; a, as above. S s 93d, 157 e 5th av, 3 br dwells; cost, \$45,000 all; o, John H Gray; a, as above.

S s 118th, 160 w Second av, 2 br tens; cost, \$24,000 all; o, Jas Watkins; a, F T Camp.

S w cor Rivington and Lewis, br school: cost, \$116,000; 0, Mayor, Aldermen, etc.; a, George W Debevoise.

Es Morris av. 75 n Gray, fr dwell; cost, \$8,000; o, Jas J Lally; o, Theo E Thomson.

Ws Tenth av, 30 n 80th, br flat and stores; cost, \$16,000; o and a, Ed E Asnley.

71 Thompson, br dwell; cost, \$50,000; o, Helen D Chapman; a, J P Lee. Ne cor oth av and 76th, br stable and stores; cost, \$8,000; o, Ed M Pearsall; a, M M Cutter.

149-151 Franklin, br store; cost, \$50,000; o, JG Parsons; a, C C Haight.

148 E 84th, br flat; cost, \$20 000; o, Jas Dickson and Geo Williamson; a, M V B Ferdon.

Es Broadway, about 200 n Macomb, br store and dwell; cost, \$25,000; o, Mrs A Hummell; a. J E Kirby. S w cor 23d and 8th av. br store and dwell; cost, \$20,000; o, John P Windolph; a, Marshall & Walters.

89 Division, br ten; cost, \$14,000; o, F W Herter; a Herter Bros.

S w Park av and 62d, br flat; cost, \$200,000; o, New York Life Ins Co; a, McKim, Mead & White. 948 oth av, br dw; cost, \$20,000; o, C Lowen and E F Hallday; a, C A French & Co.
133d and North River, 3 br coal pockets; cost, \$18,000 all; o, Theo F Tone; a, David W King.

4th and East River, 3 br coal pockets; cost, about \$7,000 all; o and a, same as above. N s 104th, 225 w 9th av, br apartment house; cost, \$22,000: 0, F H Flagge; a, M V B Ferdon.

170 Franklin st, iron and hr store; cost, \$25,000; o, H Heide; a, H M Smith & Son.

225 and 227 Hudson st, br flat and stores; cost, \$18,-000; o, L J Fonner; a, E L Angell.

25 Walker st, iton and br store; cost, about \$35,000; o, Manhattan Real Estate Assoc; a, R Berger. 547 Broadway and 118 Mercer st, store, cost, \$70,000; o, L F Post; a, J P Hatfield.

70 Carmine st, br ten and stores; cost, \$10,000; 0, M Goldstein; a, Kurtzer & Rohl.

43 Crosby st, br storehouse; cost, \$20,000; o, J D Karet, Jr; a, A I Finkle.

E s Eldridge st, 20 n Hester st, stores and lofts; cost, \$13,000; o, Sarah E Hinman: a, J H Valentine. 51, 53 and 55 Little W 12th st. 3 br stores; cost, \$10,000 all; 0, J J Astor; a, A E Hudson.

132 3d av, iron and br restaurant; cost, \$14,000; A Stewart, lessee; a, Jordan & Giller.

301 E 20th st, br workshop and stores; cost, \$8,000; o and b, P Goerlitz; a, F Ebeling. 1535 3d av, br flat and stores; cost, \$18,000; o, E Haeuser; a, Rentz & Lange.

S s 122d st, 150 e Lenox av, 7 br and stone dws; cost, 12,600 each; o, A Smyth; a, W B Tuthill.

Ws Delmonico pl.100 n 161st st,3 fr dws; cost, \$2,750 each; o, Emma E Owens; a, J H Valentine.

Es Bergen av, 107 n Grove st, br flat and stores; cost, \$20,000; o, WA Fuch; a, G Matthias.

ALTERATIONS-NEW YORK.

98 5th av, stone and br extension; cost, \$13,000; o, W Gebhard; a, J P Hardenbergh. 217 Henry st, br extension; cost, \$8,000; o, L Goodman; a, F Ebeling.

180-84 Christopher st. br extension; o, J McKeever;

20 W 36th: cost, \$10,000; o, A W Griswold; a, H C Avery.

253 W 40th; cost, \$8,000; o, Mayor, Aldermen, etc., City Hall; a, G W Debevoise. 261 Bowery; cost, \$8,000; o, M F Lyons; a, F Jenth

BROOKLVN

N s St Marks av, 100 w Nostrand av, 3 br bldgs; cost, (1) \$13,000, (2) \$7,000 each; 0, Emma A Macy; a, Chas P H Gilbert.

Es New York av, bet Park pl and Butler, 1 br bldg; cost, \$35,000; o, M E Church Home; a, Mercein Thomas.

250 w 2d av, n s 8th st, 1 br bldg used as a lard factory; cost, \$8,500; o, Davis Oil Co; a, D E Harris.

20th, s s, 175 w 6th av, 2 fr bldgs; cost, \$6,000 each; o and a, E D Yarbee. Schenck st, es, 100 s De Kalb av, 6 br bldgs; cost, \$9,500; 0, Thos H Brush; a, J G Glover.

W & Throop av, bet Quincy and Lexington av, 2 br bldgs; cost, \$30,000; o, Paul C Grening; a, I D Reynolds.

749 Lafayette. brick ten; cost, \$14,000; o, Horatio Camp; a, W H Gaylor; b, S Parks and Jenkins & Gillies.

2d av. w s, 20 s oth, 2 fr stores and tens; cost, \$7,865; Anne Tienken and Adelein Seavers; a and b, F

Halsey, n s, 150 e Throop av, 5 b s dwells; cost, each \$5.300; o and b, J J Gordon; a, R Dixon.

Herkimer, s 4, 240 w Troy av. 3 br basement frame dwells; cost, each \$3,000; o and b, George Marriott; a, A Hill. N s Herkimer st, 200 w Rockaway av, 5 br tens; cost, \$25,000 all; o, Eugene H Wilson: a, J E Styles.

N s Greene av, 190 w Reid av, br ten; cost, \$24,000; o, Thomas J Allen; a, A S Bedell.

Se cor 7th av and Berkeley pl. br, stone and terra cotta apartment house; cost, \$45,000; o, L W Winkelmann; a, M J Morrill.

Ns Prospect av, 155 w 5th av. 6 br dws; cost. \$4,500 each; o and b, Wood & Hermans; a, JF Wood. S s Clinton pl, 274 s Grand av, 4 brown stone dws, co t, \$5,250 each; o and b, Joseph I Kirby; a, A Hill

BUILDING INTELLIGENCE.

BROOKLYN-Continued

20 Dean st, br dwell; cost, \$15,000; 0, A W Dieter; a,

Se cor Hicks and Middagh sts, br dwell and store; cost, \$10,000; o, W J Hart; a, C Werner.

W s Broadway, 36 s Hancock, br dw and store; cost, \$8,000; o, J H Eckleoff; a, Th Engelhardt.

N w cor Liberty av and Cleveland st, 3 frame dws and store; cost, \$14,000 all; 0, J E Reisert; a, Th Engelhardt.

Ss Pacific st, 100 e of Hoyt st, br Nursery; cost, \$15,000; 0, St Mary's Female Hospital; a, T S Houghton.

N s Dean st, 100 e of Hoyt st. br Hospital; cost, \$25,000; o, St Mary's Female Hospital; a, J S Hough-

S s N Second st, 25 e of Lorimer st, br dw and store; cost, \$8,000; o, Charles Sussieck; a, Th Engelhardt. S s Lexington av, 100 w of Sumner av, br flats; cost, \$10,000; o, M McLaughlin; a, C D Reynolds.

Es Broadway, 28 s of Covert st, 3 br dws and stores; cost, \$30,000 all; o, WF Clayton.

S w cor Atlantic av and Hinsdale st, br dw and store; cost, \$10,000; o, Joseph Bray; a, Wm Dunman. 646 Myrtle av, br dw and store; cost, \$10,000; o, M May; a, Th Engelbardt.

S e cor Broadway and Covert st, br dw and store; cost, \$20,000; 0, W F Clayton.

S s Montgomery st, 325 w oth ave, br dw and store sst, \$10,000; o, C P Murphy; a, C P H Gilbert.

Ss Montgomery st, 305 w 9th av, br dw and store cost, \$13,000; o, Enock Putzler; a, C P H Gilbert. o8 Court st, br dwell and store; cost, \$12,000; 0, J D Willis; a, C Werner.

S s Palmetto st, 100 e Central av. 2 frame dweils; cost, 8,400 all; o, Ralser & Volhain; a, B Finkenseiper.

Es Verona st, cor Imlay st, 4 br tens; cost, \$32,000 all; o, John E Nelrow; a, Geo Damen.

N s 147th, 50 e Lexington av. 7 br dws; cost. \$84,000 all; o, Angelo Mondolfi; a, Schneider & Herter. S s Montgomery st. 345 w oth av, br dwell; cost, \$12,000; 0, Chauncey Ives; a, C O H Gilbert.

N s Carroll st, 450 e 8th av, br dwell; cost, \$12.000; o, J F Ackermann; a, C Werner.

Ns Hancock st, 275 e Tompkins av, 5 br dwells; cost, \$25,000 all; o, Henry Smith; a, HV Porter. S s South 8th st. 25 w Berry st, br dwell; cost, \$9.00; o, John Kriete; a, Benj Finkenseiper.

N e cor Nassau st and Smith Alley, br dwell; cost \$12,000; o, Chas Leik; a, Carl F Eisensik.

MISCELLANEOUS.

MINNEAPOLIS, MINN.—Calvary Baptist Church will build a \$30,000 church Park Avenue Church will erect a \$45,000 building,

CHICOPEE FALLS.—Prospect st. 4 fr. dwells; o, John McFetheries; b, D. B. Griggs & Son. WINDOM, KAN.—A school building, to cost \$25,000, is to be erected here.

MANHATTAN, KAN.—Ulrich Bros., of this city, will build a double three story stone business house.

SIOUX FALLS, DAK.—The Ryan Packing Co., of Dubuque, Iowa, will locate an \$150,000 plant here

ST. CLOUD, MINN .- A \$10,000 M E Church will

OWATONNA, MINN.—Hon George A Pillsbury of Minneapolis, has instructed plans to be drawn for a college bldg, to be built as soon as additional lands for the site are procured.

MINNEAPOLIS, MINN.--C C Phillippi will build six 2-story wooden dwellings on Cheago and North avenues near 33d street at a cost of \$15,000. Scott & Smith will build two 3-story, 12-room brick houses on 17th street, to cost \$10,000.

G W Brown, of Fort Wayne, is trying to make arrangements for locating in Minneapolis a factory for the manufacture of steel horse shoes.

ST. PAUL, MINN.—The trustees of the Central Pres-byterian Church have asked the architects of the city to furnish competitive plans for the new church edi-fice, and to have them ready for inspection by June 1. Mr Marty will erect a \$50,000 block on Seventh and Kittson streets.

Beaupre, Keogh & Davis, wholesale grocers, will erect a 7-story brick block at the corner of 4th street and Broadway.

ST. IGNACE, MICH.—The Duluth South Shore & Atlantic Railroad Co. will build a Round House.

ROCHESTER, MINN.—The Standard Oil Company is about to locate a 7,000 barrel tank in this city for a distributing point for this region.

ST. LOUIS, MO.—Laclede and Boyle av, 4 br dws; cost, \$30,000; o and b, P W Hassett. Grand and St Louis avs, 11 adj br dws; cost, \$20,-000; o, C Vonderahe; b, sub-let.

Lynch and Cambria, br dw; cost, \$9,000; o, A W & H Lucke; b, W C Popp. Lynch and Broadway, brick dw; cost, \$10,000; o, Emily and I Rose; b, A Uhrie & Son.

22d and Madison, 3 adj br dws; cost, \$7,000; o, F Ritter; b, P Riechers. r6th and Market, br store and office; cost, \$14,000; o, Flieschman & Co; b, B Weber.

WESTFIELD, MASS.—Main st, foundry, 130x25; o, H B Smith & Co.

ST. PAUL, MINN.—10th cor St Peter, 6-story brick bldg, stores, arcade, and dwells; cost, \$125,000; o, St Peter Improvement Co. Jackson, near 6th, 2-story br block; cost, \$135,000; H Hale.

Sherman, near Wilkin, 2-story fr dw; cost, \$7,000; o, C E Huberhart. 111 minor permits \$108,750.

BUILDING INTELLIGENCE.

PROVIDENCE, R. I.—Greene and Fountain, fr da. cost, \$20,000; o, Wm Blakely; a, F E Fielding,

15 buildings costing less than \$7,000.

READING, PA.—Perkiomen av and t3th st, br ds, cost, \$7,000; o, D P Schlott; a, L S Jacoby; E, H; L Rummel.

SPRINGFIELD, MASS.—St James av cor Claredst, brick and wood chapel; cost, \$8,000 to, Hip Cong Society; a, L B Walker & Son of New York.

ROCHESTER, N. Y.—Contracts have been let by the new Second Reformed Church to be built as Central av and Scio st, to cost \$10,000; c.A W Hopeman; a. Fay & Dryor

Br bldg, cor Jefferson av and Strong st, to be ted for stores and apartments; o, Marcus Hirshfield 2, Fay & Dryor

Work on the addition to the Butt's bidg on Fichange to be started soon, to have a frontare of a feet and raised 6 stories, fire-proof; o. Butts Estate c. H H Edgerton; a, Warner & Biockett Br and stone bldg, Lake av, for Raleigh Famer be used for stores and flats; c, Strauches & Smith

Plans prepared for 3-story br bldg used for field. Gorham st; o, John Daniby; a, W F Kelly Plans prepared for a br barn, Washington st.; ost \$9,000; o, Danford & Knapp; a, Otto Black

ost \$9,000; o, Danford & Knapp; a, Otto Black

Br bldg, E Main st, nr Gibbs; cost, \$20,000; a, 0 s
oote; o, Palmer Bros Br bldg, nr Clinton st, stores and flats; cost, \$10.000; o, Isaac Hirchberg; a, Otis & Crandall

Commercial bldg, br and stone, N St Paul st coc. \$30,000; a, Oscar Knebel; o. Michael Kolb

CHICAGO, ILL. -3300-58 Sartoga, 23 brick cottage. 38 to Wabash av, br dwell; cost, \$8,000; o, Mrs M H Moran; a, Ed Steube; b, Lass & Williams 206 Ashland av, br dwell; cost, \$11,000; 0, H. H. Brown; a, Holabird & Roche; b, W A & A E Wels 66-72 Adams, br addn; cost, \$13,000; 0. Natora Union Bldg Assn; a, Treat & Foltz; b, Robitson i Miner

3820 Stanton, br dwell; cost.\$8,000; o, J B Palper a, Handy & Cady; b, Denton & Scott

958-60 N Halsted, br police station and barnicos. \$18,000; 0, city of Chicago; a. Von Pelt; b. fig-gerald Bros

1077-83 Washington boul, br dw; cost. \$17,000 G. Beckwith & Fleming; a, Jno F. Warner; b, C & Moses. 2943-45 Lyman, br st and flats; cost. \$8.000 | James Hogan; a, L H Hintz; b, Prath & Nette-ink

053-65 Leavitt, br st and flats; cost, \$10,000;6, Ellig; a, Schaub & Berlin; b, C Marquer & Becker 606 N State, br dw and barn; cost, \$20,000; c, W H Bush: a, Cobb & Frost; b, L Weick

352-60 N Clark, br st and dwell; cost. \$11,000; 6. H Smith, Jr; a, Cobb & Frost, b, Jno Mountain 3145-47 Indiana av. br dw: cost, \$12,000; 0, l Hutchinson; a, H D Deam; b, Jos Boydell 346-50 S Clark, br st and offices; cost, \$12,000; Jas Goggin; a, Jas J Egan; b, Jas Goggin

3244 Lake Park av, br dw; cost, \$12,000; 0, () Pennoyer; a, Rurnham & Root; b, W A Barton 374-78 Sheffield, br flats; cost, \$10,000; a, 17 Shay and T G Donegan; a, F L Lively; b, Jos Hole

349-51 W North av, br st and flats; cost, \$15.000 o, H Abrahams; a, H S Jaffray; b, Kies & Son 349-51 W North av, br flats; cost, \$12,000; 0, a at b, same as above

DETROIT, MICH.—80 Beech, br dw; cost, \$7.00.
o, J R Brown; a, M W Scovill; b, Stevens & Co.
Russell, br factory; cost, \$7,000; o, Wood Alobe
Co; a, Donaldson & Meier; b, T Shirk & Co. Guoin, br foundry; cost, \$7,000; o, W P Kingsley, a, same as above; b, T Fairbairn.

53 Elliott, br dw; cost, \$16,000; o. Mrs N Brost, o, Rogers & McFarland; b. Topping & Fisher. 168 Woodward av, br store; cost, \$40,000; 0, Mn W H Stevens; a, M L Smith: b, same as above.
66 Garfield av, br dw; cost, \$7,000; 0, E C Var Husan; a, Scott & Go; b, M Elay.

475 Fort, br school; cost, \$20,000; o, St Joachin-Society; a, L Coquard; b, same as above. Baker, br store; cost, \$14,000; o, C E Bressler; a same as above; b, H Chandler.

107 Lincoln av, br dw; cost, \$7,000; o, J Harris; i. G E Depew; b, Green & Gold.

Jefferson, br dw; cost, \$8,000; o, H Wetsell; a. A C Varney; b, T Schriber. Second, br dw: cost, \$12,000; o, A Cooley; a. Mar as above; b, J Waterfall. 240 Adams, brdw; cost, \$7,000; 0, F Moran; a ard, same as above.

264 Lafayette av, br dw; cost, \$7,000; o, C F Purdie: a, Scott & Co; b, H Carew.

Jefferson, br dw; cost, \$15,000; o, N G William, a, J Gearing, b, A Chapoton, Jr 104 Charlotte, br dw; cost, \$10,000; 0, J Deitz; 2. J V Smith; b, same as above.

BOSTON, MASS.—Huntington av. cor Camder. bospital; cost. \$85.000; o, A L Murdeck; a, Applet & Stephenson; b, J M Keeney & Co. 66 Elm, wood dw: cost, \$7,500; o, F B & J W Austin; a and b, E W Archer.

139 Trenton, wooden dw; cost, \$7,000; o, Wm F Pigeon; a, L Underwood; b, Wilbur Goodwin. 459 461 Beacon, br dw; cost, \$44,000; o, a and b. A H Caton.

254-256 Marlboro, br dw; cost, \$60,000; o and a, S W Merrill; b, David L Rand.

115-117 Newburg, br dw; cost, \$50,000; o, Wm S Rand; a, S D Kelley; b, owner. Boylston, Dartmouth, and St James av. Public Library of Boston; cost, \$1,000,000; o, city of Boston; a, McKim, Meade & White.

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THE ENGINEERING & BUILDING RECORD

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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A DEMAND FOR IMPROVED HOUSE-TOPS.

In a recent number of the Medical Record, Dr. Gouverneur M. Smith has published a paper under the title "Wasted Sunbeams-Unused House-Tops," in which he urges that the roofs of city houses be so constructed as to afford play and sun rooms. It is not altogether a new idea, as Dr. Smith points out, for it is common enough in Oriental towns to make great use of the roofs as a lounging-place or promenade, and he might have quoted the customs of our own Pueblo Indians to the same effect. Some years ago the superiority of the roof to other parts of a house in a sanitary point of view was discussed in the public press, and after it was shown that the reception-room, the dining-room, the library, the nursery, and the kitchen would each be much healthier and more attractive if placed on the roof and encased in glass, the subject seemed to lose interest and was soon forgotten.

This is not due to mechanical difficulties in the way of construction, for although these would be considerable, and involve additional cost to that now incurred for roof-work, yet the resources of the modern architect and engineer are quite sufficient to overcome such obstacles.

The greatest of these would be due to the great differences in height between adjacent buildings, so that the occupants of a house-top would be liable to be either looked down upon and deprived of privacy, or to be supplied with foul air from their neighbors on a lower level. In avoiding these difficulties the result would, in most cases, be equivalent to adding to the house another story of the nature of a photograph gallery, with an increase of cost of annual repairs, and therefore of rent, which would greatly limit the demand for such dwellings if popular opinion on the subject remains what it is at present.

We can, however, safely premise that if Dr. Smith, and those who think with him, can succeed in creating among the average householders of New York such a demand for the use of the house-tops that they are willing to pay from two to five hundred dollars per annum for it in addition to the present rents, the architects and builders will provide for the asphalt roofs, the glass-enclosed cupolas, the perpetually-burning gas-jets in the tops of the soil-pipes, the police watch-towers, and the many other adjustments needed to make the new plan work satisfactorily in a city like this.

THE HEALTHFULNESS OF NEW YORK CITY.

THE letter of Dr. Tracy, published in the City Record of April 26, 1888, comparing the mortality statistics of London with those of New York for the last twenty years, contains matter of permanent interest, which ought to be published where it would be more readily accessible than it can be in the files of the City Record, the official journal of the city of New York, a newspaper little known beyong this city, and not easy to procure. After pointing out that the annual death-rate of London is about 20 per 1,000, while that of New York is about 26 per 1,000, Dr. Tracy gives some tables which have been compiled to show how far the excessive death-rate in New York is due to particular forms of disease. From these it appears that the excess of mortality in this city is due to diphtheria and croup, diarrhoeal diseases, phthisis,

and kidney diseases. Most of these are what are called preventable diseases—that is, they are due to causes which may be more or less done away with.

Dr. Tracy concludes "that the overcrowding in New York (16.37 persons to a dwelling in 1880, as compared with 7.8 in 1881 in London) and the trying climatic conditions make it very improbable that the death-rate of this city can ever be reduced as low as that of London.

We also think it improbable, but for somewhat different reasons, among which is our form of municipal government and the peculiar relations which ward politics occasionally bear to municipal sanitary engineering work. The excess of deaths in New York appears to be largely due to diarrheal diseases and probably occurs chiefly among the infants of the tenement-house population during the summer months. Dr. Tracy has not attempted to compare the death-rates of the slums of East London with those of the tenement-house region of New York, but it is probable that these do not differ much except as indicated above.

So far as climatic conditions are concerned, it is doubtful whether either city has any marked advantage, and the fact that New York is much more overcrowded than London is not a thing independent of municipal sanitation, but a part of it, and shows that we are more in need than our neighbors of improvement in this matter.

A CITY ENGINEER'S FEES.

THERE seems to be some dissatisfaction in San Diego, Cal., with the charges made by the City Engineer for street improvements which are assessed directly upon the property benefited.

According to the San Diego Union, the City Engineer receives a salary of \$200 per month, and in making preliminary surveys and establishing street lines and grades the time of his assistants is charged to the city at their actual wages of from \$2.50 to \$5 per day, but in laying out, superintending and estimating improvements in progress he appears to be employed by the contractor, and though his own services do not seem to be charged for, those of the same assistants are, and at the rate of from \$10 to \$12.50 per day, and these charges are included in the contractor's bill and assessed upon the benefited property.

This practice does not seem to be authorized by the law, which merely fixes the monthly salary of the City Engineer, and the property-owners are becoming uneasy at what they consider an unnecessary expense.

While it is difficult to see any good reason for making such a distinction in methods of charging for work done by the same men on the same improvement, it does not follow that the City Engineer is overpaid; a good city engineer rarely Usually it would be cheaper for the city to employ him at almost any price than to try and get along without him, but it would be certainly much more satisfactory for all parties to have a definite and uniform system of charges agreed upon and established by law.

There is probably much diversity in the methods adopted by different municipalities for paying their engineers, and we should be glad to hear of those that have given satisfaction, and perhaps even of some that have not, if the objections are pointed out and the remedy suggested.

THE IMPORTANCE OF MANUAL TRAINING.

CERTAIN young Englishmen have recently come to America to find business as electricians. They are well educated in the books, but have no knowledge of handicraft. Herein is a vital mistake. There is no place here for such men, either in our electrical establishments or in any of our industrial enterprises. To secure a place for one's self the young man must be able to do with his own hands the work he is to direct others in doing. Educational systems are more and more taking this into account on this side of the

SANITARY INSPECTION.

This is the time of year when health inspectors ought to be at work in all the smaller towns and villages making a systematic house-to-house inspection, and seeing for themselves what the condition of cellars, outhouses, privy-vaults, etc., etc., really is.

It educates the public, calls the attention of householders to dangers and nuisances which they would otherwise overlook, and many of which they will gladly abate when they are pointed out, and is in many respects among the most useful work which a health department can perform.

We are glad to see that this fact is recognized in the last quarterly report of the Illinois State Board of Health, and that local health boards are urged to again push the work. It is a great error to suppose that it is only the tenement-house district of a large city that needs regularly repeated examinations from a sanitary point of view; there is not a village in this country that would not be the better for them at least once a year.

FALLING FLOORS IN A HALF-DEMOLISHED BUILDING.

On the 23d inst, the floors of a brick building that was being taken down on the corner of Broadway and John Street, New York City, fell, causing the death of one of the workmen and the injury of several others.

The accident appears to have been due to an excessive accumulation on the upper floors of bricks and other rubbish from the walls that were being removed.

It does not seem as if it ought to be necessary to tell those engaged in such work that after the building has been stripped of its trimmings and before the walls are touched, all the floor-boards should be removed from all the floors so that all bricks can fall through to the cellar, and no dangerous accumulations on the floors be possible.

THEATRE CONSTRUCTION IN RUSSIA.

ACCORDING to a correspondent of Indian Engineering. the Russian seems to have sounder notions about the building of a model theatre than his English critics. One such Thespian temple was opened at Odessa last December. In fifteen seconds the body of this theatre can be altogether separated from the stage by the drop of an iron curtain. The auditorium is heated with hot air; all the rest of the building with hot water. The electric is the only light used; dynamos and engines for its generation being located a mile away from the premises. Water is laid on all over the theatre. In the lower parts it is supplied direct from the town reservoirs, and in the upper parts from three iron tanks on the roof, fed by a steam-pump. The stage is not only separated from the auditorium by the iron curtain, but also from the back premises by automatic iron doors leading into fire-proof corridors, which in their turn are divided from the dressing-rooms by iron doors. The flooring of the whole building is made of iron.

CLASSIFIED INDEX OF PATENTS.

THE Franklin Institute of Philadelphia has adopted the following very proper resolution:

"Resolved, That the Franklin Institute earnestly recommends and urges upon the representatives in Congress to give operative effect to the recommendation of the Commissioner of Patents by enacting promply such laws as will secure the preparation, by persons of competent skill and knowledge, of concise and thoroughly indexed classified abridgements of patents for invention, and the publication thereof, and the placing of such publications on sale at moderate charges, and accessible to the public in libraries for the better diffusion of knowledge on such subjects."

SINKING PILES IN QUICKSAND.

THE following methods of piling for the false work of bridge spans were used by Mr. R. Fulmer, then with the King Bridge Company, in the erection of work over the Brazos River, Tex., where the bottom was a quicksand that had given great trouble with ordinary supports. Near Hempstead one 220 feet and one 175 feet highway spans were carried over an elevation of 45 feet above the water, which was about 8 feet deep.

Cottonwood piles 60 feet long and up to 20 inches in diameter were procured and sharpened at their butts.

A beam projecting forward first from the pier and afterwards from the bents already set served to swing the piles into place. A scow whose width corresponded to the required distance between bents was moved to the pier or last-erected bent, and men on deck with levers capstanwise twisted each pile around its vertical axis and it rapidly sank 12 or 15 feet, and when released was held firmly by the skin friction of the sand, fully answering all requirements. In this way a gang of 10 men set 80 piles a day at a cost of not more than \$25.

At the Granburg crossing of three 175 feet spans at a height of 40 fect, a device similar to the grillage of the Hanover Pond trestle illustrated in our issue of December 24 was effectively employed.

Trestle bents of the required height and 25 feet wide were framed, the posts were cut square at the foot and on their lower ends two 3x12-inch planks 18 feet long were spiked flatwise against the end surface so as to form a shoe projecting about 5 feet beyond the trestle on each side, the two planks lapping 2 feet at the centre where they were spiked together. These bents were then floated out, raised up and braced in position and proved firm and solid. When taken down to move forward to the next span the shoe plank usually became loosened and floated off, but this only occasioned a little trouble in spiking them on again.

A SANITARY CONFERENCE IN MINNESOTA.

THERE will be a sanitary conference held in Rochester,

THERE will be a sanitary conference need in Kochester, Minn., May 20 to 31, inclusive. The programme is: Tuesday, May 20.—Reception of conference by city authorities, with an address by the Mayor and other prominent citizens; paper, "The Relation of Citizens to the Official Administration of Public Health—State and Municipal," Professor W. W. Folwell, of the State University.

Wednesday, May 30.—General subject is: "The Orof Local Boards of Health; "Water-Supply for Families and Communities, its Sources and Dangers;" reports of delegates on local water-supply; existing legislation for the protection of public and private water-supply; demonstrations of methods of water analysis available for local boards and health officers; paper, "The Relation of the Citizen and the Home to the Health Officer and His Duties," Dr. A. T. Conley, Health Officer of Cannon Falls; paper, "The Duties of the Citizen as Respects Vaccination, and Other Means for Prevention of Infectious Diseases," Dr. W. A. Hunt, Health Officer of Northfield

Thursday, May 31.—General subject: The disposal of and garbage and control of offensive trades. Papers and discussions by Secretary State Board of Health, Dr. Staples, Health Officer of Winona, and delegates generally. Second subject: Preventable diseases of men and animals; papers by Dr. E. J. Davis, State Board of Health; Dr. G. A. Hanson, Leper Hospital, Bergen, Norway; Dr. Bowers, Superintendent Second Hospital for the Insane, and others

A PROPOSED BRIDGE TO EAST BOSTON.

THE necessity for some more direct communication between Boston and East Boston than that supplied by the ferry has become increasingly apparent, and some time since a committee of the Board of Aldermen advised the construction of a tunnel. The committee of the Common Council, however, to whom their recommendation was referred, think that a bridge would be preferable, though they are yet undecided as to whether "a surface or an elevated bridge would be more desirable," meaning, we presume, either a pile or short-span bridge with a draw or one sufficiently high to dispense with such an arrange-

The latter committee seem to have investigated the matter pretty thoroughly, having visited Chicago, Cincinnati, Covington, New York, and Brooklyn, and their report includes a brief description of the Washington and La Salle Street tunnels at Chicago, the two bridges at Cincinnati, and the yet unfinished Manhattan Bridge over the Harlem River in New York City.

ONE or two of the earliest locomotives were designed to be propelled by legs arranged to kick out behind, and now a Camden inventor, whose name we considerately withhold, has patented the same thing as a "motor for street-railways."

A C. O. D. GAS-METER.

THE Indian Colonial and Foreign Engineer and Builder says the preference of the poor for kerosene oil a pears to be largely due to the fact that it can be purchased in small quantities—whereas the use of gas results in fermidable quarterly bills. Several attempts have been mad: to meet small consumers in this matter; and the corporation of Birmingham (England) is now about to institute an entirely new departure in the sale of gas by the use of "pay-before delivery" meters, devised by Mr. Brownhills. One or more pennies are dropped into an opening, and the regulating apparatus of the meter liberates a quantity of gas of corresponding value—after which it stops, awaiting the advent of fresh pence. The coins accumulate in a locked receptacle, and are removed by the collector at intervals.

PUMPING BY ELECTRICITY.

MESSRS, IMMISCH & Co., of Kentish Town, London, have designed and erected an electric pumping-plant for the St. John's Colliery of Messrs. Locke & Co., Normanton, Eng., which is described in the Electrician as being very successful.

It raises the water at one lift of 900 feet at the rate of 7,200 gallons per hour. The pumps are differential, with two 6-inch and two 41/4-inch rams running at a speed of 25 revolutions per minute, against a pressure of 400 pounds per square inch.

The actual power expended on the water is 33 horsepower, and that exerted by the dynamo is 53 horse-power. showing a utilization of about 62 per cent.

OAKLAND SEWER SYSTEM.

FROM the reports of the discussion at the meeting of the Oakland, Cal., Board of Health, it would seem that the sewerage system of that city is defective and inadequate. The attempt, however, of different members to improve the system by proposing to authorize the construction of certain sewers is a mistaken one. The true way to find out what is needed is to have the City Engineer authorized to retain as consulting engineer a gentleman who has made a specialty of this matter, and who. with the data in the possession of the City Engineer, could recommend a comprehensive and intelligent system. To build a sewer here and there, as each member of the board thinks is necessary, is a very unsatisfactory way of dealing with a problem of this sort.

LOUISVILLE CANAL.

THE Kentucky Legislature surrendered the Louisville Canal to the U. S. Government. The city of Louisville has since desired the privilege of discharging their sewage into it. This was objected to by Major Stickney, U.S. Engineer's office, and now the Secretary of War has made a report sustaining the objection. The result will probably be an intercepting sewer. Whether the Government or the city of Louisville is to pay for it is now the matter under consideration.

ARCHITECTS may be interested in knowing that it is reported that Cornelius Vanderbilt has offered to erect for the Union Club of this city, on four lots owned by him on Fifth Avenue, such a club-house as they desire, furnishing all the money needed, the club to pay four per cent. per annum on the amount.

PRESS dispatches state that a syndicate has been formed to tunnel the Detroit River at Detroit. It is composed of D. O. Mills and George Bliss of New York, Mr. Laidlaw of the Bank of California, and several officials of the Michigan Central Railroad.

THE Indian Engineer, published in Calcutta, announces that it will hereafter appear weekly instead of fortnightly as heretofore, the subscription price remaining unchanged. We are pleased to note what we presume may be considered an evidence of prosperity and an increased demand for engineering literature.

OUR ARCHITECTURAL ILLUSTRATIONS.

A COUNTRY RESIDENCE-R. H. ROBERTSON, ARCHITECT.

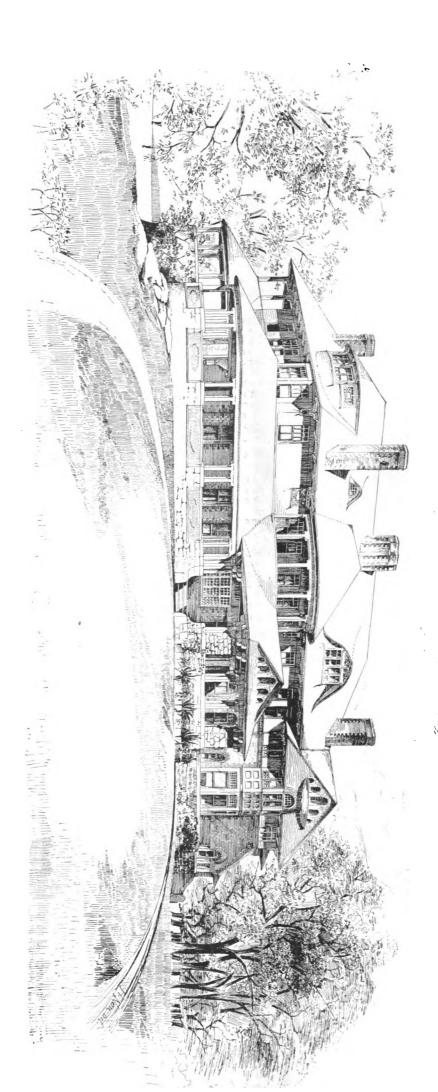
THE basement and terrace is of stone. The first story walls of brick, shingles above.

OLD COLONIAL DETAILS. - MANSION HOUSE, TOWSON-TOWN, MD.



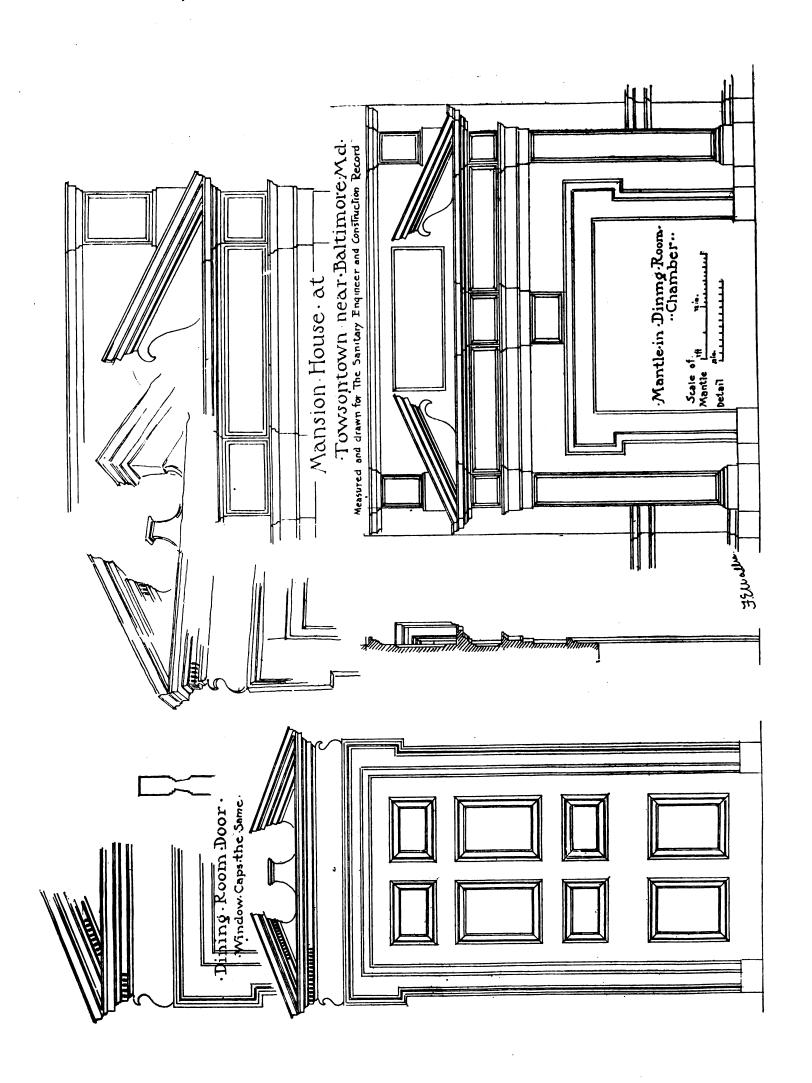
R. H. ROBERTSON, ARCHITECT.

A COUNTRY HOUSE.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

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The Same

BUILDERS' AND CONTRACTORS' ENGINEER-ING AND PLANT.

No. XXXV.

(Continued from page 352.)

ERECTION OF POUGHKEEPSIE BRIDGE.—NO. 5.*

RIVETING TRAVELER, DERRICK, AND GENERAL PLANT.

FIGURE 23 shows the general design and arrangement of the riveting-traveler, which is a novel device built expressly for this work, where it has proved of great value and convenience.

Longitudinal girders L L support the pairs I, J and K of braced posts that carry platform M M, in the centre of which a pivot and track receives turntable G, which revolves freely with its platform N N.

Over this upper platform are carried a special engine E and its boiler, and a Blake pump P which delivers into

*No. 1 of these articles, containing the General Description and an account of submerged work, appeared in our issue of March 3; No. 2, Masonry, issue of May 5; No. 3, False Work, issue of May 12; No. 4, Travelers, issue of May 10.

In our mention, in the introductory article of this series, of the persons connected with this interesting work, we accidentally omitted to say that the drawings loaned us by Mr. J. F. O'Rourke were, many of them, prepared by him to accompany his paper on the Poughkeepsie Bridge that was presented at the last convention of the American Society of Civil Engineers.

cylinder S, where pressure is maintained by weight W, which is guided in braced frame U.

D D are projecting beams, with track upon which truck Y runs, and in turn carries trolley G through a fixed nut, in which a threaded rod T passes. The revolution of T by chain and sprocket-wheel H gives transverse motion to G, and the longitudinal motion is easily obtained by a slight pull in the plane of D.

An hydraulic-riveter R (Tweddell system) is suspended by differential hoist from G, and thus has a universal adjustment, permitting it to easily reach any rivet in the lower part of the bridge.

Z Z is the flexible hose bringing water under pressure from S.

B is a Sturtevant blower, furnishing blast for rivet-furnace F. C is a hand shears for cutting rivets, etc.

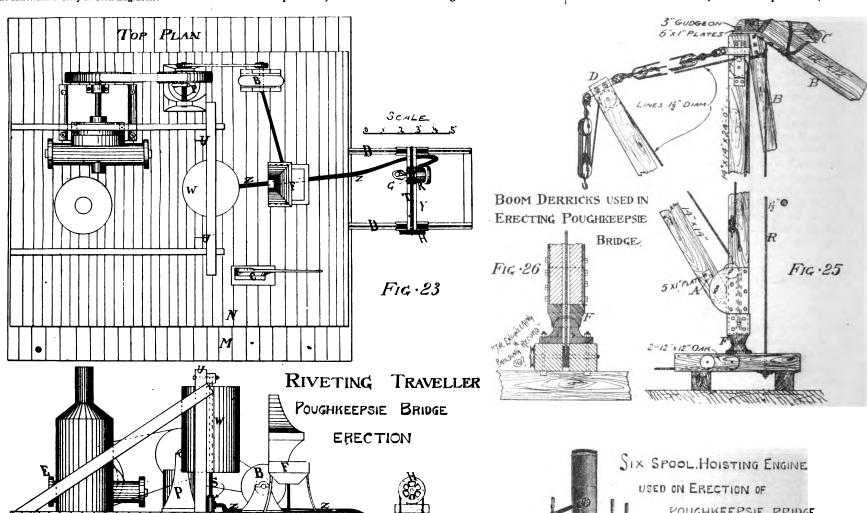
Figures 25 and 26 show the details of boom-derrick, designed and used by Mr. Baird. It has a special footblock at F, a reinforced bearing at A, and link connections at D, designed so as to weaken the timber very little and obviate cross strains. B B are braces across whose tops a saddle-block C is lashed and tightly anchored down by rod R, screwed up under the foot-block, thus preventing any possibility of the derricks "kicking" when the boom is

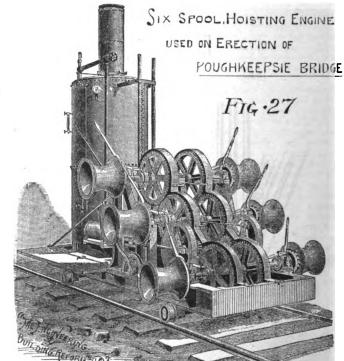
swung out from B B. Several of these derricks have been placed on top of the false work and in other places and have proved efficient and satisfactory in severe and constant

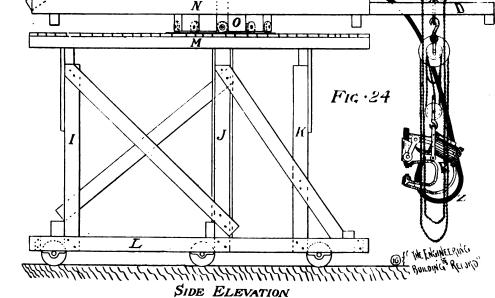
Figure 27 is Baird's improved hoisting-engine, built by J. S. Mundy, of Newark, N. J. It is of 20 horse-power, with double cylinders 7x12 inches. The 6-inch heads have separate clutches and gearing, enabling each one to hoist, lower, or hold on independently of all the rest. By a simple arrangement the track-wheels can also be quickly and easily thrown into gear and the engine transformed into a locomotive able to travel ten miles an hour. Three of these machines are used on this erection and have become almost indispensable.

The erection plant for this work is very complete and well chosen. A great part of it is new and much of special and improved design, and all is strong and serviceable. The magnitude of the work requires a large outfit, some of the principal items of which have been 2 dredges, 8 hoisting-engines, 2 pile-drivers, 14 scows, 3 steamboats at different times, and one ferry launch continually, besides the machines and structures described above, and many car loads of small tools and necessaries.

There were more than 40 sets of triple tackle, with







patent 16-inch sheaves, and 2,500 feet each of best Manilla line. 11/2 inches diameter. For erection of iron-work a force of 130 to 140 men was required; masons and other workmen would raise the total force to about 350 men, employed at the busiest time. After the completion of the false work the progress of erection depends upon the supply of iron, and when that is in readiness it has been very rapid. Mr. Baird estimates that with all the material at hand he could raise, connect, and swing one 525-foot span in 12 days.

In one day a 125-foot section of the tower on pier No. 2 was raised and connected.

In another day 108 lineal feet of the truss was raised 130 feet and connected complete. The duty of the hoisting-engines has been very severe, 34 tons at a single lift having been raised by one engine and the 100-foot trav-

The plan of erection, as previously outlined, is very simple. The shore-arm spans were first erected, all material being hoisted from the water's edge and placed in position by the traveler at one operation; connections were then made and the rivets driven by hand. The 525-foot span between piers 2 and 3 followed next; timber, supplies and some iron was raised by a boom-derrick placed at the west end of the false work, but most of the members were brought in large lots by scows to foot of piers 2 or 3, the erecting traveler moved out to end of false work, directly above, and the pieces raised by its mast and boomderricks delivered by them to trucks running through the traveler, and by them distributed in required positions. The traveler was then run over the work, and, lifting the truss members for a panel, held them until connected and self-sustaining, at any convenient time after which the riveting-traveler ran along through the trusses and under the erecting-traveler and drove all field rivets, except occasional ones that could only be reached by hand. After this span was completed the cantilever-span between piers I and 2 was erected in the same way as the shore-arms had been, and the centre connection was made Jan. 2, 1888.

The danger from ice in the river delayed the false work for the span between piers 4 and 5, but it is now being put up, and the completion of that span and the remaining cantilever-arms will probably be rapidly accomplished. (TO BE CONTINUED.)

PAVEMENTS AND STREET RAILROADS. No. XXX.

(Continued from page 281.)

ASPHALT PAVEMENTS IN THE UNITED STATES.

AT a recent meeting of the Board of Improvements of Cleveland, O., City Engineer Walter P. Rice made the following report of his investigations of asphalt pave-

"The best material for pavement purposes seems to be the Trinidad asphalt, which is controlled by the following companies: Barber Asphalt Paving Company, Warren-Scharf Asphalt Paving Company, and National Vulcanite Company. The latter company is able to command asphalt only for laying pavement other than the Barber, while the two former lay pavement under the same specifications, but in separate territory. There can therefore be no competition and but one bid can be received under the same specification, and to all practical intents cities or individuals using the street pavements are subject to such dictation as may be imposed as to cost of all repairs and resur-

examined over twenty streets in Washington, D. C. paved with asphalt, vulcanite, and coal-tar distillate. The age of these pavements ranges from five to fourteen years. In general they are in good condition, show frequent re-pairs, and are subject to light traffic. Pennsylvania Avenue and K Street are typical respectively of heavy and light travel. Pennsylvania Avenue, the pavement of which is part Trinidad and part Neufchatel rock asphalt, is about part Frindad and part Neutchatel rock asphalt, is about 105 feet between curb lines, age 12 years, never resurfaced, about 10 per cent. of wearing surface gone, largely patched in places, lack of uniformity, some ruts. In K Street the pavement is vulcanite, 50 feet between curb lines, age 14 years, never resurfaced or patched, condition almost perfect. K Street is used as a standard of comparison in all vulcanite specifications vulcanite specifications.

The Buffalo pavements with a few exceptions are not yet of sufficient age to justify the formation of any opinion except in case of early failure, as on Broadway, paved three years ago, resurfaced once and giving out again in places. Franklin Avenue, paved with asphalt nine years ago, is the oldest exception and without repairs, is in excellent condition. Cottage and Bryant Streets, paved eight years ago, are in good condition.
"The reduced formula for asphalt is: Asphalt, 13.16

to 15.78; heavy petroleum oil, 1.84 to 2.21; fine sand, 70.00 to 65.00; pulverized carbonate lime, 15.00 to 17.00. There is little or no bond between the base and wearing

"The reduced formula for vulcanite is: Asphalt, 4.4 per cent.; coal-tar distillate, 13.4 per cent.; clean sand, 53.6 per cent.; pulverized stone, 26.8 per cent.; hydraulic scement, 1.2 per cent.; flour sulphur, .14 per cent; air-slaked lime, .28 per cent.

"The main differences are the percentages of asphalt

and the value of coal-tar distillate versus petroleum. vulcanite is the cheaper as regards first cost, although costing slightly more for maintenance.

"Asphalt pavements are liable to the following defects: First, the formation of 'wave surface, especially on grades (probably due to lack of cohesion between the wearing surface and base). Second, the formation of transverse cracks, more ant to occur in wide roads and intersections and un doubtedly due to contraction and expansion caused by variations of temperature. Third, a rot or disintegration variations of conference in the gutters and necessitates the use of stone or a coating of coal-tar; this does not seem to be the case with vulcanite. Vulcanite or coal-tar distillate pavements:
First, are affected at a lower temperature than asphalt, and ometimes present evidence of a flow of material toward the gutters during warm weather, often rising nearly to the top of the curb and necessitating a cutting away of the material. This is not observable in the asphalt. Second, vulcanite is not so liable to transverse cracks (the forerun vuicante is not so habit to transverse cracks (the forerun-ners of repairs), or to wave surfaces as the asphalt on account of greater longitudinal strength due to a closer union of base and wearing surface. On the other hand, in making repairs the wearing surface of asphalt can be easily removed and renewed, while in the vulcanite no such separation can be made and in resurfacing it is necessary to overlay the whole surface. This slightly affects the grade of the street by raising the same above the curb grade. Third, vulcanite has a more granular surface than he asphalt.

"Sheet pavements are sightly, pleasant to drive over, and easy to clean; but if not cleaned, as might be the case in this city, any accumulation of material would from the nature of the surface be ground to an impalpable powder unpleasant to travelers and detrimental to lawns, the fine dust being blown into houses and stores. Such pavements would undoubtedly on business streets attract travel from parallel routes, thereby compelling the pavement of the latter with the same material as a matter of self-defense no The mixture has to be nicely tempered, requires the satisfying of many conditions and expert manipulation. It is largely affected by temperature and climatic conditions. In extreme cold the surface cracks and becomes friable in extreme heat the surface rolls or creeps under traffic presenting a wave surface uncomfortable to travel over In this connection I would state that the temperature at Washington ranges from 150° above zero insummer to 10° below in winter, or 160° Fah., and Captain Griffin, United States Corps of Engineers, of that city, is authority for the statement that the Washington pavements suffer more during the three months of winter than during the remaining nine months of the year.

The expense of laying foundations for street pave ments is a large part of the total cost, and when the paving is worn out, or a city is tired of repairing the same, then the expense of removing the foundation will be large, as it is too near the established grade or curb grade to lay stone or other than sheet pavement on. It cannot be laid next to street-railway tracks, as it will not stand the shearing action of wheels. The science of laying sheet pave-ments is still to a large extent tentative. That good ones can be laid has been proven, but there is no certainty that the standard can be reached on any particular street. Two separate batches of material mixed under the same formula and specification may be totally unlike as regards durability. In discussing sheet pavements a standard of comparison might be outlined as follows: First, moderate first cost; second, durability; third, minimum resistance to traction; fourth, secure foothold for horses; fifth, healthfulness; sixth, noiselessness.

"First, sheet pavements do not satisfy the first requirement much better than dressed block; second, I should give dressed block the preference as regards durability and ultimate cost; third, the resistance to traction is undoubt edly less on sheet pavements; fourth, such few experi-ments as have been made indicate fewer accidents to horses on sheet pavements than granite, but do not think it would hold good for Medina; fifth, both sheet pavements and dressed block are healthy, and the asphalt filling of the latter sufficiently fulfills all sanitary requirements; sixth, sheet pavements perhaps fulfill the last requirement better than stone, but there is the sharp click and ring of the horses' hoof, although the vehicle itself makes little noise. In making repairs in the case of a stone pavement 50 to 75 per cent. of the old material can be used over again; it is worthless in the case of a sheet

" Finally, I consider sheet pavements a luxury, rendering any city attractive where successfully laid and main-tained. Their introduction should be simultaneous with tained. Their introduction should be simultaneous with the adoption of a continual repair system to secure the best results. There is small choice between the asphalt and vulcanite pavements. I would advise against laying asphalt or vulcanite pavements on any of the thoroughfares of this city, and would further advise that the city should consider its introduction as an original pavement and only consider its introduction as an original pavement and not on the repaying of any street. Further, if property-owners are desirous of obtaining these pavements, the city should, in my estimation, demand not less than ten years' guarantee, the pavement to be turned over in good condition at the expiration of that period."

THE USE OF SALT-GLAZED VITRIFIED PIPE IN WATER-WORKS CONDUITS.*

IT having been my lot to construct two quite extensive systems of gravity water-works within the last six years, one at Amsterdam, N. Y., costing \$285,000, and the other at Little Falls, N. Y., on which I am now engaged, costing \$300,000, and in both cases the source of supply being so far distant that the use of cast-iron pipes for conduits would have rendered the construction on the gravity plan almost practically prohibitory, as the additional cost would have placed too heavy a burden on the taxpayers—at least they would have fancied so—my attention was called to the use of salt glazed vitrified pipe as a substitute for iron; as also in rebuilding the conduit at Johnstown, N. Y., which was done during the time stated. nduit at In each case I have successfully constructed the conduit of vitrified pipe, and all of them to this date have not required one dollar's repairs, but are actually in the same condition as when laid, all having been in constant use from date of completion.

I have therefore thought that a paper descriptive of the method of construction might be of service to some of the members of this association should they be called upon to design a conduit in similar localities.

I will first give a brief description of the alignment and grades of the Amsterdam and the Little Falls conduits.

DESCRIPTION OF AMSTERDAM CONDUIT.

The water-supply at Amsterdam is six miles distant and consists of three small mountain streams, which I successfully diverted by vitrified-pipe conduits and open channels into one. From this point I brought them across the country to the channel of a summer dry stream, upon which, at a point near the city, I built a combined storage and distribution reservoir. The three mountain streams and distribution reservoir. The three mountain streams were known as the McQueen and Rogers streams, and the dry stream as the Bunn Creek. There are two intervening ridges, or divides, between McQueen and Bunn Creeks, necessitating heavy cutting to divert the water.

McQueen Creek is dammed by a substantial masonry structure at a point just below the junction with the West Branch, the dam being four feet high; its channel was widened and deepened for about 1,000 feet back, a new open channel or reservoir was excavated in the direction of Bunn Creek for about 800 feet, and until the excavation gave a cut of seven feet, to allow a sufficient depth of soil cover the conduit and protect the same from frosts. At this point of termination of open channel a substantial masonry inlet-chamber was designed and constructed, having suitable iron racks and fine screens, with bulkhead gate to shut down the water. From this point a nead gate to shut down the water. From this point a vitrified salt-glazed pipe conduit, 18 inches in internal diameter, has been laid to a suitable point to empty the water of Rogers, West Branch and McQueen Creeks into Bunn Creek. The pipe is of the pattern known as hub and spigot, and is laid with Portland cement joints. The conduit is laid upon the true hydraulic grade line, excepting two or three points of depression, where it has been necessary to depress from one to two feet to admit of sufficient covering of soil over the pipe without changing or embanking up above the original surface of the ground.
The conduit is laid to a grade with a total fall of 18.14 feet for 10,361 feet. From this point the surface of the ground is precipitous in direction of Bunn Creek, having passed now through the second divide, and a 12-inch vitrified conduit is laid down to the channel of Bunn Creek with a fall of 38 feet in 1,000 feet. The conduit has a capacity when running full of 2,851,300 gallons per diem, being in excess of the amount which may be expected from the Rogers, West Branch and McQueen Creeks. Rogers Creek is dammed by a similar masonry structure four feet high; the water is then diverted and carried east-erly in an open channel through about 1,000 feet of low undulating ground to the west edge of a road. At this undulating ground to the west edge of a road. At this point a masonry inlet-chamber, similar to the one on McQueen Creek, is constructed, and the water is passed through a 15-inch vitrified salt-glazed pipe conduit 1,500 feet long, emptying into an open water-channel of the West Branch, and both empty into McQueen Creek at a point above the dam upon the same. From the end of vitrified-pipe conduit on Bunn Creek two miles to the storage channel of Bunn Creek two miles to the storage and distribution reservoir of 100,000,000 gallons capacity.

DESCRIPTION OF LITTLE FALLS CONDUIT.

The conduit at Little Falls is a much more elaborate affair. The water-supply is a mountain stream known as Beaver Creek. It lies due north from the village of Little Falls, and is distant about eleven miles.

Beaver, as well as Spruce Creek, into which it empties near the point of diversion, is a tributary of East Canada Creek: the line of Beaver Creek runs about due east. The ground lying between Beaver and Spruce Creeks and Little Falls is depressed by two streams, Gillett and Cathaticane, or Crum Creek, both running south-easterly, Gillett Creek emptying into East Canada and Cathaticane, or Crum Creek, into the Mohawk River, and dividing the interven-ing ground about equally into four sections, or two divides and two basins or depressions.

and two basins or depressions.

I have utilized vitrified salt-glazed stoneware pipe wherever I could locate the lines to a hydraulic grade line or line of no pressure, and in the two depressions or valleys where the conduit is under pressure, substituted castiron pipe, carrying the same up to the grade called for by hydraulic grade line.

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^{*}Paper by Stephen E. Babcock, read at the convention of the American Water-Works Association at Cleveland, O., April 17, 1888.

Beaver Creek is dammed by a substantial masonry structure at the point of divergence. The dam has a spill-way to feet wide and floods 0.75 of an acre. The dam is six feet high; the south abutment of the dam is formed into a receiving chamber and inlet of conduit line, and is provided with a movable inlet weir, which may be raised or lowered to allow any quantity of water up to capacity of flow into the chamber and thence into the conduit; the saddle of the dam is two feet above the top of conduit. The water starts off from the receiving chamber in a 20-inch iron conduit pipe for 50 feet, to take the first shock of the water while acquiring its velocity; it is thence con-tinued with 20-inch vitrified salt-glazed stoneware pipe for 10,000 feet, grade 8 feet to the mile, the line following the contour of the ground required to give the necessary fill on top of pipe to protect the same, and to insure its lying in natural and not artificial ground. Here a heavy sand cut is encountered for about 1,000 feet. From this point, as a heavier grade can now be given, 18-inch vitrified pipe begins and continues 9,400 feet, grade 13 feet to the mile, to the edge of the basin of Gillett Creek; from here the line is continued with an 18 inch cost ince here the line is continued with an 18-inch cast-iron pipe 6,200 feet long, which follows along surface or contour of the depression of Gillett Creek, rises up to the southerly side of said depression, and enters at a point at which the hydraulic grade line produced would give natural ground to start off with vitrified pipe again. Vitrified pipe starts here, 18 inches diameter, and is

carried along on the hydraulic line to the beginning of the depression of Cathaticane, or Crum Creek, 9,100 feet. From this point 16-inch iron pipe, 9,400 feet long, grade 32 feet to the mile, is used across the depression and up to the top of the divide, the southern shed of which runs to the village of Little Falls. From this point 15-inch vitrified pipe is again used for 900 feet, grade 79 feet to the mile; then 12-inch vitrified pipe is used for 1,000 feet, grade 105 feet to the mile; the conduit proper stops here, giving a total distance of 8.72 miles.

SPECIFICATIONS FOR PIPE.

The essential points in the specifications for the salt-glazed pipe which I adopted are as follows for the Little Falls Water-Works:

The pipe shall all be of the best quality of salt-glazed vitrified stoneware pipe. All shall be of the kind known as "hub and spigot."

The pipe shall have a thickness of one-twelfth the diameter of the pipe. (This, it will be observed, is heavier than the ordinary commercial pipe.)

The hubs shall be three inches deep to the main pipe.

(At Amsterdam I used the ordinary depth of hub, which is two and one quarter inches, but at Little Falls increased the depth to three inches, my experience convincing me that the increase would make easier and more satisfactory work.) All hubs must be of sufficient diameter to receive to their full depth the spigot end of the next following pipe, without any chipping of either pipe, and shall have a space or joint room of not less than three-eighths of an inch in width all around for the cement mortar joint.

All pipes supplied shall be molded under pressure, and the hub of every pipe shall be pressed on or formed with the body of the pipe, and care shall be taken that the hubs are truly concentric with the pipes. Five per cent. will be the allowable inspection divergence of the greatest from the least internal diameter, in departing from a true cylindrical cross section.

The pipes shall be well glazed all over. All pipes not

well or uniformly glazed will be rejected. All pipes not perfectly burned will be rejected. All pipes having any fire cracks which the engineer shall consider injurious shall be conderaned.

All pipes having transportation cracks shall be peremptorily rejected.

All pipes having blisters which the engineer shall con-

sider injurious shall be condemned.

All pipes having excrescences or iron pimples in the in-

terior of the pipe which in the opinion of the engineer may impede the flow of the water shall be rejected.

All pipe not thoroughly vitrified or fused, or which betrays the use of improper materials or methods in its manufacture, shall be rejected.

manufacture, shall be rejected.

If a piece be broken out of the rim forming the hub of a pipe it shall be rejected if the length of said broken piece is greater than one-tenth of the diameter of the pipe,

piece is greater than one-tenth of the diameter of the pipe, measured on the inside face of the hub or socket.

If a piece be broken out of the hub end of a pipe which shall extend over one inch into body of pipe, or shall be greater in length than one-tenth of the diameter of the ipe, the pipe shall be rejected, and two or more such reaks, either of hub or spigot, shall condemn such pipe, even if both are under the area designated.

SPECIFICATIONS FOR PIPE-LAYING.

The conduit will be laid to true grade from end to end of each section of vitrified pipe. The cast-iron portion of conduit shall be laid to conform to the contour of the ground where laid, and the trench shall be of such depth to require a back-fill of 31/2 feet on top of pipe when

The joints of the vitrified pipes shall be made of Portland cement mortar, in combinations with gaskets of clean, sound hemp yarn or jute, braided or twisted, and tightly driven, as follows:

Each length or strand of the jute shall be of a diameter to loosely fill the width of joint, and shall be thoroughly soaked in a Portland cement mortar, made of a thick paste of clean cement and water, and shall be of a length to go once around the circumference of the pipe and lap over two or three inches. This shall be driven home with calking

tools, and shall be succeeded by a sufficient number of strands to fill the joint-room to within one-half an inch of the outside of hub, breaking joints with the laps. driven home and thoroughly joined together. The j driven home and thoroughly joined together. The joint shall then be finished by filling the remaining one-half inch of joint-room with a clear Portland cement mortar, the joint-room when finished being completely filled all around the pipe to the outside lines of the hub.

The contractor will furnish a bag, stuffed with shawings or hay, of a size sufficient to fit the pipe, rather tightly, with a rope about ten yards in length fastened to the mouth of the bag.

mouth of the bag.

The bag must be placed in the first pipe, the rope passing through each pipe as it is laid down. After the joints are made, the bag is then to be drawn forward at such times before the cement has set as to smooth off and produce a such control of the contr duce a true surface at each cement joint and a continuous thin coating of cement on the lower half of the pipe.

In refilling the trenches, the earth shall be carefully packed and rammed. Care shall be taken to give the pipe a proper bearing throughout the entire length. The earth filling above the pipe shall be sufficiently packed and rammed to prevent after-settlement, and puddled to the satisfaction of the engineer when so directed.

In rock excavation the back-filled material around the

pipe and for 1½ feet above the same shall be earth, free from stone or rock fragments. The balance of the trench may be filled with such portion of the rock excavation as shall measure not more than one cubic foot, provided a sufficient amount of earth be mixed with the same to bond it together like a mortar, and if necessary suitable material satisfactory to the engineer shall be borrowed to make said filling.

From the first hundred feet from the receiving chamber the pipe shall be bedded in a wall of mortar extending all the bottom of the trench and extending up to pass the centre of the pipe, filling the trench completely up to this point. The object and intent of this being to prevent an under leakage at the beginning or receiving chamber end of the conduit.

In order to secure a natural bed for each pipe, the con tractor will cause the trench to be excavated down to such

depth as the engineer shall direct, by the regular trench depth as the engineer shall direct, by the regular trench gang, to be followed up by a trained gang to dig the additional depth just to grade as fast as the pipe is laid.

Having now in detail described the method of laying out and constructing the vitrified-pipe conduits, I submit the following remarks on the durability and cost as compared with a cast-iron conduit of equal capacity, using the Little Falls conduit as the basis of comparison that being the Falls conduit as the basis of comparison, that being the more elaborate and difficult construction, as also introducing the feature of substituting cast-iron pipe in the intermediate sections where pressure in the pipe is encountered.

DURABILITY OF VITRIFIED PIPE.

That sound vitrified pipe is itself durable would seem hardly worth devoting much time to demonstrate. Sewers built of it have been unearthed in the excavations of Pom-

peii and Herculaneum, which cities were destroyed by an eruption of Vesuvius, A. D. 79.

Rev. F. S. De Hass, late U. S. Consul to Jerusalem, Palestine, writes: "Vitrified clay is among the most durable mercials have a While the palest and the part of the palest and the palest able materials known. While the marble palaces, temples, and tombs of Rome and other ancient cities have crumbled to dust, those built of brick remain almost perfect. The use of terra-cotta for images, ornaments, drain-pipes, coffins and vessels of different kinds dates back to the remote ages. Sewers, and tiling used in construction. the remote ages. Sewers, and tiling used in construction, have been found in Pompeii, Troy and Nineveh, also in Ur of the Chaldees, the home of Abraham, and the oldest cities in the world. Here it was in general use, and the tombs are drained with clay pipes as sound as when laid in the ground to content of the content

in the ground 4,000 years ago.

"The coffins also are of the same material, and of different shapes, some like caskets with lids and others round like bottles, which were sealed up after the corpse was in-serted; and there they are by thousands at the present ime, sound as when they came from the potters' Nothing is now known more lasting than terra-cotta.

Whether the ancients used salt to glaze their pipes with does not appear, but that it adds to the durability of the pipe the following description of the process of glazing will

Salt-glazed pipes are necessarily made from good clay, which will stand a great degree of heat. The pipes after being made and dried, are placed in a close kiln and grad-ually subjected to an intense heat. When this heat is of sufficient intensity, coarse salt is thrown upon the fire in small quantities; a portion of the salt vaporizes, which vapor, combining with the silica of the clay, produces a soda-salt or glass, which is a glaze and is a part of the body of the pipe. It requires good clay to endure heat of suffi-cient intensity to vaporize the salt, and this heat is so great that the pipes are thoroughly vitrified and very hard, and glazed inside and out.

DURABILITY OF CONDUIT AS LAID.

As the conduit as laid upon my plan-i. e., laying the pipe to the hydraulic grade line required to discharge the amount of water needed—will always be a line of no pressure, conditions precisely similar to the ordinary sewer as laid, there can be no tendency to rupture or break of any kind due to the water passing through the conduit, and the only danger to be apprehended is from an external pressure crushing the pipe, or to an unequal bearing or settlement of the conduit. The following tests show the strength of the pipe to resist external pressure:

Tests made by Mr. A. V. Abbott, engineer, New York. A wooden box was made large enough to receive the pipe

and allow from two to three inches of sand to be packed in at the sides, giving the pipe, as near as possible, the posi-tion it would occupy when laid in the earth. The pressure tion it would occupy when laid in the earth. The pressure was then put on top of the pipe, with the following results, average of two pieces each size—each piece being twenty-four inches long: Diameter, 18 inches; thickness, 1½ inches; crushed at 14,233 pounds; diameter, 15 inches; thickness, 1¼ inches; crushed at 24,030 pounds; diameter, 12 inches; thickness, 1 inch; crushed at 11,540 pounds; diameter, 6 inches; thickness, ½ of an inch; crushed at 28,065 pounds

crushed at 28,065 pounds.

Again, the fact is that in deep cuts the filling over the pipe is partially supported by the sides of the cut, the angle of support or repose of the back-filling being at an angle of 45° with a horizontal at the top level of the pipe, the earth or back-filling forms an arch from this point up, so that the only point to be carefully guarded is to see that the back-filling immediately surrounding the pipe is carefully put in, and that the pipe is laid on the natural ground, so that there may be no undue, unequal settlement; and in places where the ground is soft and yielding, to build up with concrete.

RESULTS AT AMSTERDAM AND LITTLE FALLS.

That the results of construction bear me out in this. I have the proof in the actual working of both the Amsterdam and the Little Falls conduits. The Amsterdam conduit is laid generally in very heavy cuts, ranging from 12 to 22 feet. At Little Falls, one heavy cut for 1,000 feet is in the deepest point 32 feet; and yet, Mr. A. H. Del-graff, Superintendent at Amsterdam, writes in every report to date, that there have been no repairs on the conduit.

His last, the sixth report on the works, 1887, says:

"Conduit Lines.—The conduit lines still continue to do
the work assigned them in a satisfactory manner, and no
moneys have been spent in repairs during the year."

At Little Falls the upper half of the conduit to Gillett

Creek has been in use two years, and the whole since July last, and as yet there has not been one dollar's repairs, although on the iron portion we have had three breaks. If the proof of the pudding is chewing the string, I think these two conduits have demonstrated their durability. The same thing holds true of the Johnstown work.

The conduit at Johnstown is about one mile long, fifteen inches in diameter, and similar in construction to the Amsterdam conduit. It has now been in use four years without any repairs.

CONTINUITY OF SMOOTH PIPE.

I desire to call attention to the fact that the use of a bag I desire to call attention to the fact that the use of a bag drawn ahead continuously after the pipe-laying has the effect of producing a continuous smooth pipe the entire length of the conduit, the small particles of cement mortar which are forced up into the chamber of the pipe in calking being smoothed over in the line of the flow of the water, and the joints entirely obliterated. Very careful measurements on a weir at the outlet of the Little Falls conduit showed, when conduit was running full head, a daily flow of 4 250 000 gallons although the calculated daily flow of 4,250,000 gallons, although the calculated capacity was 3,000,000 gallons.

VALVES IN LINE.

To prevent a pressure ever being put on conduit, under no circumstances must any valve be placed in the line, but it must be an open conduit from end to end; the water must be regulated at the head, or by the introduction of a branch pipe with valves on branch, which may then be located at any point at which it is desirable to draw the water off. On the Little Falls conduit I placed branches and blow-offs on each section of the iron pipe at their lewest points.

ECONOMIC FRATURES OF COST.

The most important item in the whole matter, however, is the relative cost as compared with cast-iron pipe. saving is well worth looking into wherever new works are being designed, or additional supplies added to existing systems, to see if it is applicable to the case in hand.

Taking the actual results of the cost of constructing the

Little Falls conduit, the comparative statement, excluding the cost of dam, inlet-chamber, etc., common to any plan, will be as follows: total cost of conduit, 8.72 miles long,

\$86,085.27; vitrified pipe portion, 5.63 miles long, \$45,544.43; cast-iron portion, 3.09 miles long, \$40,540.80.

If cast-iron pipe had been used exclusively in place of vitrified pipe, the sizes, owing to the contour of the ground, would still have been the same as were used in the line as

would still have been the same as were used in the line as actually constructed; the total cost of conduit at contract prices would have been \$147,409.29.

If it had been possible to follow on the hydraulic grade line the entire length of the conduit, using vitrified pipe exclusively, the total cost would have been \$57,206.64.

From the actual workings of the conduits at Amsterdam, Johnstown, and Little Falls, I am satisfied that, if proposity laid a salt glazed pipe conduit is as durable as any

erly laid, a salt-glazed pipe-conduit is as durable as any that can be laid, as well as being economical, as the above results of actual work show. There being no pressure, there can be no breaks to repair; maintenance is reduced to the minimum.

LIMITATION OF ITS USE.

Vet I think that I must state that the application of vitrified in place of cast-iron pipe must be limited to conduits of two feet to thirty inches in diameter, and to those localities where a line can be run to follow the hydraulic grade line, terminating at a distribution-reservoir adjacent to town, which will give sufficient head for the distribution system, or ending at a pump-well.

CONCLUSION.

I believe that the use of vitrified-pipe conduits will enable many localities to avail themselves of the better and



purer water-supplies that are, without its use, too far distant to be financially available. For example, the Little Falls water is brought at such a moderate cost as to enable Falls water is brought at such a moderate cost as to enable them to sell their surplus water at a profit at five cents per 1,000 gallons. It would have been too heavy a burden with cast-iron, or at least the taxpayers would have objected to the heavy expense. They probably would have resorted to pumping from the Mohawk River, which takes all the drainage of the cities above them. In the one case they have a pure mountain trout stream of three to four million gallons flow. In the other they would have had million gallons flow. In the other they would have had the sewage-contaminated Mohawk River, the constant daily expense of pumping, with no surplus of water to sell. DISCUSSION OF PAPER ON USE OF SALT-GLAZED VITRIFIED PIPE FOR WATER-WORKS CONDUITS.

In reply to various questions from members of the association and guests, Mr. Babcock said that the length of pipe sections at Little Falls was two feet.

The total fall of the pipe is 130 or 140 feet from surface of collecting reservoir to point of distribution. The two or three breaks reported in the cast-iron pipe had been due

By true hydraulic grade was meant a grade sufficient to discharge through a pipe of the given size the required amount of water.

No difficulty was experienced in laying the salt-glazed pipe through quicksand, which was frequently encountered and was along most of the line at Johnstown, where the and was along most of the line at Johnstown, where the old pipe had two summits and gave constant trouble, which was further increased by action of quicksand under the dam. A new masonry dam was constructed and from a concrete chamber above it the water was drawn into a stand-pipe provided with a regulating valve which admitted it to the salt-glazed pipe. Much of the trench was dug through quicksand saturated with water, which was made available to increase the supply in the pipes the joints available to increase the supply in the pipes, the joints were all left as wide open as possible and covered with ryestraw, then filled around with earth or sand as usual. No

water leaked out of the pipes, but much was brought in, Mr. Holme, Jr., admitted the durability of salt-glazed pipe, but wished to call attention to the greater economy and equal success of the wooden mains lately constructed in Denver. The line is laid irrespective of grade, is nearly seven miles long and sustains pressures as high as 40 pounds per square inch. Railroad ties of redwood, similar to that used in the pipe, have lasted for 40 years and it is expected the pipe will last at least 25 years, although it is so cheap that it could be renewed three or four times It is so the priod with more economy than to use iron pipe.

No leaks or breaks have yet occurred but could be remedied by the insertion of a new stave.

Mr. Holme described the details and construction of this pipe, which was illustrated in our issue of February

Secretary Decker mentioned the recent construction at Quincy, Ill., of 1,500 or 2,000 feet of hard pine pipe simtlar to the Denver pipe that is giving good satisfaction. It was briefly described in our issue of March 24.

Mr. T. N. Hooper described a six-inch bored redwood pipe that he saw in the Sanoba Valley, California, which had been buried 15 years and sustained a pressure of 80 rounds per square inch, and was in perfect condition when pounds per square inch, and was in perfect condition when he examined it.

President Fanning described a pipe that he had built of Georgia pine for a line 700 feet long, with 40 feet fall and an initial head of 10 feet. The pipe was 72 inches in diameter and made of staves planed from 4x4-inch timber. diameter and made of staves planed from 4x4-inch timber. The knives in an ordinary planing machine were set to give the proper angle to the abutting faces of the staves. The pipe was built up from the lower end, the staves breaking joints and a piece of hoop iron three-quarters of an inch wide and slightly longer than the width of the stave being set at each joint between the abutting ends of the staves in a saw-kerf made three-eighths of an inch the staves in a saw-kerf made three-eighths of an inch deep in the end of each stave and parallel to its outside face. This made a perfect joint between the four adjacent staves when they were tightened up. They were in 15-foot lengths and hooped with iron bands, from one-half inch thick at foot of the pipe to one-quarter inch thick at the head. At two deflections of the pipe butt-joints were made in the plane bisecting the angle and covered by a wrought-iron sleeve and tightly calked inside and outside.

Mr. Fanning also described the use, twenty years ago, of one and a half miles of 24-inch Scotch glazed pipe laid under an initial head of 14 feet with a fall of 12 inches per

under an initial head of 14 feet with a fall of 12 inches per mile from a storage-reservoir of 18 acres surface.

A stand-pipe was provided at the head of the pipe, and the joints were made with wrought-iron sleeves filled with cement. The pipe has given satisfaction up to the present

time.

Mr. Fanning stated that the durability of wooden pipe is due to its protection from air, and mentioned some timber he had recently removed from the mud near low-water mark, where it must have been buried nearly one water mark, where it must have been builted hearly one hundred years ago. It was a chestnut bridge sill, and a chip taken just beneath the sap wood was tough and fibrous and in perfect preservation.

Instances were related of pipes recently dug up in Connecticut that were in good preservation and still perfectly

serviceable after being buried eighty or ninety years. One was a bored wooden pipe 16 inches in diameter, with 2-inch hole and cup-joints. The other was a cement pipe 5 inches external and 1½ inches internal diameter, with

Mr. Y. Nakajima, Hon. Mem. W. W. A., being absent, his paper on the "Water-Supply of Tokyo, Japan," was

read by title only and ordered to be printed in full in the

PRACTICAL HINTS FOR DRAUGHTSMEN. By Charles William MacCord. A. M., Sc. D., Professor of Mechanica William MacCord, A. M., Sc. D., Professor of Mechanical Drawing in the Stevens Institute of Technology. New York: John Wiley & Sons. 1888. Cloth, 100 pp., 9/x11/4 in. \$2.50.

"The leading object of this treatise is to explain various modes of representation which are in many cases better than the precise ones of projection; for mechanical drawings often convey false impressions by too close adherence to the truth, and become obscure by being too

This quotation from the preface very accurately indicates the scope of the first part of this book, and its promise is well fulfilled.

Most draughtsmen of intelligence and experience will find that they have anticipated many of Professor Mac-Cord's conclusions, but that only proves their correctness. To the young draughtsman, and indeed to many old ones, the careful study of the first three chapters will be very profitable, and there are few employers of draughtsmen that would not find it a paying investment to place the

book in the drawing-room for reference.

To make drawings theoretically correct is comparatively To know when and how to make judicious variasimple. Thinks when and now to make judicious varies tions and labor-saving short cuts can only be learned from experience, either one's own or another's, and the latter is

here supplied.

The advice about drawing instruments and materials, although helpful in many respects, should be followed with some caution. The best size for compasses is given some-what differently in two different places, and the sometimes what differently in two different places, and the sometimes convenient lengthening bar is unsparingly condemned, as is also the drawing pen with hinged blade, although a hinged blade is shown on the compass pen. It is to be hoped that no one will spend money for such bow instruments as are shown on page 68. They are destitute of needle points and have the adjusting-nut on the wrong side. The objection that shouldered needle points prevent the making of very small circles is entirely overcome by filing a little off of one side of the shoulder, by which it is possible to make circles very much smaller than Professor MacCord's minimum of one-thirtieth of an inch. The little compass, with stationary spindle, much used by bridge draughtsmen for making rivet-holes and heads in large members, is not mentioned, and generally all tools bridge draughtsmen for making river-noies and neads in large members, is not mentioned, and generally all tools for special purposes are ignored or condemned. The pro-portional dividers is stigmatized as a "brazen impostor," which it usually is when made of brass, but a good German silver one is on some rare occasions a great convenience. The beam compass recommended requires too light a bar for convenient or reliable use with very long radii. A bar of T-section, to the rib of which the sockets may be clamped and from which they do not "drop off," with ordinary care is much more satisfactory, and if the top is made flat the compass can conveniently be laid on its back when out of hand without danger of inking the drawing

board.

The Professor's style is rather dogmatic and not infrequently "slangy," which, while it may seem to make the book more readable, somewhat detracts from its dignity. Such phrases as "back the bull off the bridge," "Calvanistic observance of the letter of the law," and "face the guns and carry the battery," however they may serve to enliven a class-room, seem out of place in a scientific work.

The book concludes with an appendix giving convenient tables of proportions of bolts, nuts, pipes, etc., and the whole is conveniently indexed.

REPORT OF THE NEW BEDFORD WATER-WORKS.

WE have received from Mr. R. C. P. Coggeshall, Superintendent, the eighteenth annual report of the Water Board of New Bedford, Mass., for the year 1887. This city contains an estimated population of 36,000, of which some 31,750 are adjacent to the mains, and about 30,080 were actually supplied with 1,112,302,789 gallons of water last year, being a daily consumption of 3,047,404 gallons, giving an average of 85 to each inhabitant and 101 to each secretary and 555 to each of the 5405 tags in use. to each inhabitant and 101 to each of the 5,495 taps in use. Of this water ¼ per cent. passes through 60 domestic meters and 17 per cent. through 42 manufacturing meters. It is supplied through 54 miles of pipes (three miles added last year), from 4 to 30 inches in diameter, whose repairs cost last year \$21 per mile. Nine miles of this pipe is cementlast year \$21 per fine. Nine fines of this pipe is cement-lined wrought-iron, whose ultimate replacement with cast iron is recommended. The pressure varies at the centre of the city from 29 pounds by day to 37 pounds at night. Twenty-eight motors and elevators are in use, 4 motors and 22 meters having been added during the year. The works were built during 1866-9 and belong to the city. The supply is drawn from a storage reservoir formed by a dam across the valley of the Acushnet River, from which the water flows by gravity seven miles to the city, where it is pumped to an elevated distributing reservoir. There are three pumping-engines: No. 1, a McAlpine; No. 2, a Worthington, and No. 3 a high-duty Worthington, which Worthington, and No. 3 a high-duty worthington, which have pumped during the year a number of gallons against an average dynamic head in feet and with an average duty in foot-pounds per 100 pounds of combustible as follows: No. 1, gallons, 220,337,172; head, 134; duty, 88,088,013; No. 2, gallons, 121,455,608; head, 126;

* This interesting paper was printed in our issue of March 17, in ignorance of Mr. Nakajima's intention to present it at this convention, information of his purpose having been received only on the day of publication.

duty, 57,407,881; No. 3, gallons, 754,340,094; head, 127; duty, 93,142,804. The coal used was anthracite egg, with price per gross ton delivered and percentage of ash as follows: Lindermann's Sugar Loaf Lehigh, \$5, 10.2 per cent.; Old Company's Lehigh, \$5,48, 11.9 per cent. The cost of pumping per million gallons figured on total pumping station expenses of \$9,436, of which \$4,210 was for fuel and \$3,868 for labor, was: for raising to reservoir \$861, and for raising one foot high 6.7 cents.

Mention is made of the valuable work done by the State Board of Health in making water analyses, of which a table is given. Mr. Desmond Fitzgerald, Superintendent of the Western Division of the Boston Water-Works, is quoted as saving that the evaporation during a year from

quoted as saying that the evaporation during a year from a water surface is about 35 inches, and may in summer reach six-tenths of an inch in one day, equal to 16.291

reach six-tenths of an inch in one day, equal to 16.291 gallons per acre.

A very fully detailed report is given of a 24-hour test made by Messrs. William Rotch, William R. Billings, and R. C. P. Coggeshall of two upright Corliss boilers, 64 inches diameter and 13 feet 7 inches long, with internal fire-boxes and 128 two-inch tubes. They developed 79 H. P. (on the basis of 30 pounds of water evaporated per H. P.), and evaporated 10.25 pounds of water at 212 for every pound of combustible, burning 7.92 pounds of coal per square foot of grate per hour.

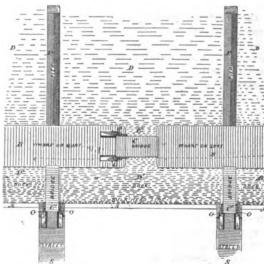
The monthly consumption of water and the height of the water in the storage reservoir are shown graphically and form an interesting diagram. It seems a pity that the curve of the rainfall could not have been added to make it complete, especially as the figures for it are given at the bottom of the same sheet. The monthly consumption varied from 72,272,875 gallons in April to 104,961,884 gallons in July, and the daily from 1,646,144 Sunday, April 24, to 4,238,221 on Thursday, July 21. No mention whatever is made of waste of water. The whole regallons in July, and the daily from 1,040,144 Sunday, April 24, to 4,238,221 on Thursday, July 21. No mention whatever is made of waste of water. The whole report of 124 pages is very carefully prepared and represents much work. Extended tables give the location of every pipe, hydrant and stop-gate with much minuteness. An index would have added to its convenience.

Novelties.

A DOCK SYSTEM.

THE arrangement of this system of docks is shown very clearly by the illustration, it being only necessary to add that the bridges are movable, of the balanced lifting or bascule type, though any other convenient draw-bridge may be used.

The illustration represents only a section of the system. which may be indefinitely extended. The piers are intended to accommodate long vessels like ocean steamers, while the smaller vessels can be accommodated in the inner



docks D' D', which they can enter through the opening E, so placed midway between the piers that it will not be obstructed by vessels lying at them. By lifting the bridges C' C', vessels can pass from one section to another of the inner dock D' D' without the hazard and delay incident to

passing around the pier heads.

The inventor is John M. Cornell, of the firm of J. B. & J. M. Cornell, 141 Centre Street, New York City, who proposes this as a plan for the relief of the water-front of

C. F. CASSLEMAN, of Chicago, Ill., has patented a system for canal-boat propulsion which consists essentially of an endless cable driven by machinery and running on suitable supports in opposite directions on either bank of the canal, to which the boats are attached as required.

NAT. W. PRATT, of Brooklyn, N. Y., has invented a pneumatic gun in which the projectile automatically shuts the door after it as it goes out.

STEPHEN E. RHODES, of Saratoga Springs, N. Y., has invented a radiator with a swivel joint at one end, to which the steam and return pipes are connected, and around which the radiator can be swung, if desired to change is position or to clean under it.



PLANT OF THE BOSTON HEATING COMPANY. No. V.

(Continued from page 353.)

THE CONVERTER.

THE water, as I have already shown, is merely the vehicle for the transportation of heat. And now having indicated the method by means of which we introduce it inside a customer's wall, the question arises, How can it be used?

Very broadly it may be stated that our service is perfectly adequate to afford a supply of heat for any purpose whatsoever requiring a temperature of 400° or less, whether it be for heating, power, cooking, chemical operations, or any branch of manufacturing. The various appliances, however, by means of which the heat contained in the water may be utilized are as varied as the different branches to which it may be applied.

For heating simply, two plans present themselves. Hot water can be introduced directly into a radiator which may occupy the same position that the furnace in the house does, and may warm a quantity of cold air supplied through the cold-air box, and send that air heated through the flues that are already in place, so as to warm the building in the same way that the furnace does at the present time, only substituting a hot-water coil for the glowing mass of incandescent coal.

Where the edifice is already piped for steam, or in case of a set of offices where a very varied supply is desired, steam heating in the usual manner may be resorted to by the introduction of a device called a "converter." This contrivance may be very briefly described as a steam dome, for in reality in our system it occupies the same place that a steam dome does in a boiler. If, in imagination, you will conceive an ordinary boiler to be stretched out so as to occupy two miles of space, you will have a very fair conception of our system as applied to the distribution of steam heat.

The end of the copper pipe, as it comes in from the street, is attached to a reducing-valve. This reducing-valve we make of rather peculiar construction, so as to specially adapt it to withstand the pressure to which it is subjected, and also to afford a regulator of unusual sensitiveness and durability. By means of the pressure-reducing valve most of the pressure on the water contained in the copper pipe is removed, and the water allowed to flow into a large iron receptacle which forms the steam dome proper. By the removal of the pressure a part of the water is thereby permitted to take up the superfluous heat and to expand into steam.

A small steam-gauge is attached to the converter, the purpose of which is to constantly record the pressure, and to enable the reducing-valve to be set so as to give a pressure of any desired amount. From the top of the converter a steam-pipe conveys the steam away as fast as it is formed, and carries it to any part of the building where its use may be desired. At the bottom of the converter a return main is connected to a float-trap placed on the inside of the converter. Another pipe is used to convey back to the converter the condensed water from all the radiators, so that there may be little or no loss in the system. As fast as this condensed water accumulates in the converter, the trap previously alluded to discharges the water into the return main and allows it to flow into the main in the street whence it is conducted to the station.

As a precautionary measure a safety-valve is attached to the converter, so that in case of any failure of the reducing-valve to act in a proper manner, which might possibly allow a greater pressure to come on the converter than is intended, this safety-valve will open and permit the contents of the converter to flow into the return main and relieve itself entirely.

For supplying steam to an engine we generally calculate that to preserve an adequate supply, it would be necessary to have the volume of the converter at least ten times that of the cylinder of the engine which it is desired to feed. So for a large engine we merely increase the size of the iron steam dome to such proportions as shall always pre-

serve the requisite amount. For cases where both heat and power are desired in the same building, as frequently occurs, we use a compound converter with two reducingvalves so arranged that the water first introduced from the street shall expand into one chamber, giving, for example, a pressure of sixty pounds of steam for the purpose of driving an engine. As soon as the water, under the pressure of sixty pounds, is discharged from this first chamber in the converter by means of the trap, it is received in a second one where by means of an additional reducing-valve. the pressure is again reduced and the remaining portion of heat contained in the water allowed to expand a part of it into steam which may be used for heating. By this means we are enabled to reduce the temperature of the water the greatest amount, thereby returning it to the station as cool as possible.

THE ASBESTOS COVERING.

In a system of this kind protection from radiation is an exceedingly important consideration. After a number of exhaustive experiments on nearly all of the non-conducting covering now in use, we decided to adopt a covering made of asbestos. The covering is simply a roll of pure asbestos-fibre 1½ inches thick. It is made by taking the asbestos from the mines, carding it in the same way that cotton-wool is carded, and winding it around a cylindrical roll. After the mixture is dry a saw is run along the side of the roll cutting the covering in two; then the roll is opened and taken off. On the outside of the asbestos is a solidly-woven cloth made of asbestos rendered water-proof by an admixture of plaster of Paris and held in place by a wire netting.

Returning for a moment to the section of conduit, Fig. 3, page 328, we have in the centre the pipe itself; outside of the pipe 1½ inches of asbestos, with a water-proof asbestos covering. An air-space of 4 inches separates the asbestos from the first brick arch; then a second air-space of 2 inches and a second brick arch. So we think the system is about as thoroughly protected from radiation as could be done. As to the insulating power of the asbestos this experiment may be interesting.

I had an air-bath made so arranged that it could be kept at a constant temperature of 500° Fah. A sheet of the asbestos covering was laid on top of the air-bath. In contact with the upper side of the asbestos a piece of 2-inch yellow pine plank was placed so as to cover the sheet entirely. Between the asbestos and the plank a second registering thermometer was introduced so that the temperature between the abestos and the plank could be accurately ascertained. The experiment was continued for several days, during which time the air-bath was constantly maintained at a temperature of 500°, and the highest temperature ascertained as occurring between the asbestos and the wood was 158°.

Postscript, February 10, 1888.—The main and station of the Boston Heating Company was completed and in

readiness to commence circulution about the middle of December. The pipe line, after being tested from the station round to the station again complete, was thoroughly washed out to remove all dirt and grease by pumping water through it for two days; the main was then connected with a battery of boilers of 200 horse-power, underneath which a slow wood fire was started so as to gradually heat the water contained in the boilers; a steady circulation was at the same time maintained through the whole of the main, so that as fast as the water was warmed in the boilers it might be sent out into the main, thus gradually heating the whole system.

About ten days was consumed in warming the main to about 380°; during this time the whole line was carefully watched to ascertain whether any leakage developed, and whether the expansion joints worked in a proper manner; and no trouble of any kind was experienced, the main under heat being found to be fully as tight as it was under cold-water pressure. All of the expansion joints operated as had been anticipated, taking up the expansion as the temperature increased in a perfectly satisfactory manner. After the temperature of 380° was attained, a solution of potash was pumped into the main and circulated for several days in order to remove all grease and red lead, so that the system would be full of clean water, After two or three days circulation of potash water, the mains were cleaned by allowing the hot potash water to escape and refilling it in the boiler with fresh warm water. This cleansing of the main was continued until the water showed no signs of potash or grease.

After this thorough cleansing had taken place, the various consumers, whose house-connections had been made, were, one after another, turned on to the line; and, at the present time, the company is heating about twenty-five large buildings, and supplying power to some engines. So far all the consumers on the line have expressed complete satisfaction with the service rendered to them.

Experiments on the losses by radiation show that in a circuit of nearly two miles the entire loss in the supply main does not exceed three per cent, even in the coldest weather. In all probability, as soon as the masonry of the conduit shall have had sufficient time to thoroughly dry out, even this small loss will be gradually reduced.

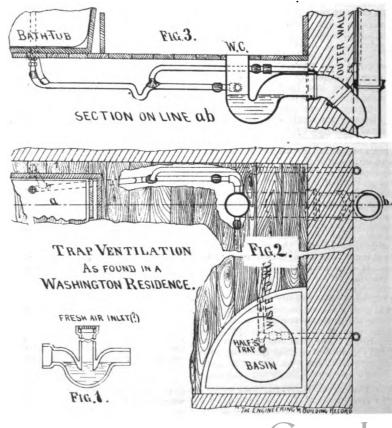
dry out, even this small loss will be gradually reduced.

Testimonials from parties using steam show that the steam furnished is exceptionally dry. One engine is run from an exposed pipe over 80 feet from the converter, and no trouble whatsoever is experienced with water in the cylinder, showing that even after the steam is exposed to this amount of radiation it is as dry as steam furnished by ordinary boilers.

A SPECIMEN OF BAD PLUMBING IN WASH-INGTON

WASHINGTON, D. C., May 5, 1888.

SIR: My attention was called a few days ago by Mr. James Lockhead, master plumber, of this city, to an interesting and curious specimen of ignorance and bad work-



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manship recently discovered by him in a dwelling to which he had been called to find the cause and correct the evil of an offensive odor that had been noticed by the occupant for some time and which had grown to be well-nigh unbearable.

On taking up portions of the floor in the kitchen, near the wash-tubs and sink (where the smell was worst), the earth beneath was found to be covered with greasy filth. evidently from leaks in the drain-pipes. Removing these it was found that the 11/4-inch lead pipes from the fixtures were connected with branch terra-cotta pipes (2-inch) only by slipping the former into the latter, with scarcely a pretense of cementing the two together. The 2-inch terra cotta branch pipes entered a 3-inch of the same material, at right angles—the ends of the smaller pipes projecting into the larger about an inch, and but imperfectly cemented.

This 3-inch pipe was in an area beside the house, and received no other branch before being enlarged to 4-inch, and taking a rain-leader (trapped), soil-pipe (continued to above roof) and two area drains (with bell-traps).

On looking down into what was evidently intended for a fresh-air inlet it was at first supposed that there was an obstruction in the trap, for water was visible seemingly in the air-inlet. By digging down to the trap, however, it was discovered to be of a form in which the cleaning hole was located on the upper side of the lowest part of the trap, and the plumber (presumably in ignorance of the object of the fresh-air inlet) had extended this to the surface and placed a grating over it. (See Fig. 1.)

After correcting this it was found that there was still no air-current through the soil-pipe. This led to further excavation, which revealed another earthenware trap of the same sort on the main drain, a short distance below the foot of the soil-pipe—the cleaning hole being made this time to serve for the admission of area-water through a bell-trap at the surface. Thus all channels for the direct escape of air from the space between the kitchen branches and the main trap being closed, the drain became "airbound" when large volumes of water were emptied from the wash-tubs, backing up the water, forcing it through the open joints, and forming deposits in the pipes—the space between the entrance of the wash-tub branch and the sink branch (about ten feet) being nearly full of the pulpy substance peculiar to laundry drain-pipes

In the bath-room in the second story was found an interesting method of trap ventilation, illustrated by plan and sectional elevation in Fig. 2. The traps of bath and basin being ventilated in the usual way, the waste-pipe from each fixture is discharged into the water-closet trap above the water. The water-closet in use (removed before the sketch was made) was of the type known as "plunger," with no trap except the one shown—under the floor. The basin vent-pipe, after passing through the outer wall, rose vertically about eight feet, then ran about twenty-five feet nearly horizontally-descending, however, instead of rising, so that a trap containing a gallon of water was formedand, finally, rising again vertically some eight feet more. All of this outside vent-pipe is of 11/4-inch wrought iron, unprotected from corrosion. The soil-pipe (also unprotected) is run independently to above the roof, following the same general course as the vent-pipe.

This work was done three years ago.

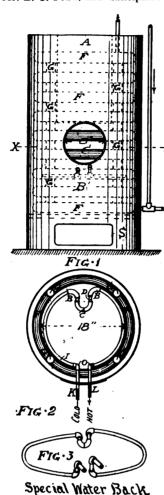
DANA C. BARBER.

SPECIAL WATER-BACK.

THE accompanying figures illustrate a puzzle that recently arose in the plumbing of a Cleveland residence and the solution effected by the fourth plumber that was called to do the job. Figure 1 is an elevation of the boiler for the hot water heating system for the house. In the cylindrical shell S are placed a series of horizontal circular pipes, F, F, etc., with communicating branches G, G, etc. Inside these rings are the coal reservoir A and the fire-box B. In the latter it was desired to place a circular pipe, I, to heat water for kitchen use. To avoid interference with the fuel, it was necessary that this ring should fit close to the inside of the boiler, thus requiring a diameter of 18 inches, and it could only be introduced through a door, C, inches in diameter.

Figure 2 is a cross-section through X X, and shows the water-back I in position and its construction. Two pieces of pipe, A A, were bent to required curve, and united by the street L's B B, the return C and the nipples D, and had elbows, O O, fitted to the outer ends. The pipe was then doubled up by folding on the joints at D, and readily inserted through the door, then opened out, as shown in

Fig. 3, and the hot and cold pipes K and L connected. Soon complaint was made that it heated too well, and that hot water came through the cold faucet. The plumber, Mr. E. C. Fraw, had anticipated this trouble,



and remedied it by placing a check-valve in the cold pipe to prevent return of hot water, and a self-closing cock on hot water branch at the sink, which, if subjected to much pressure, would automatically open and relieve it.

PROPOSED PLUMBING REGULATIONS FOR PITTSBURG.

WE learn that a committee of the Master Plumbers' Association of Pittsburg has been engaged for some days past in preparing plans for regulating plumbing-work in that city. At present there are no regulations whatever governing the Bureau of Plumbing, and the inspector asked the Plumbers' Association to prepare something which might aid him and Chief Brown in establishing rules. The inspector himself has been hard at work in the same line, corresponding with other cities, and getting all the light he can on the subject. With what information he gains in this way, his own practical knowledge, and the suggestions which will come from the master plumbers, a code of rules will be made, and ordinances passed by the City Councils giving power to enforce it. As it is now, it would make no difference what regulations the inspector might think were proper, he has no authority to compel persons to observe them.

The master plumbers are not only willing that there should be, but they are really anxious to have laws governing their trade and work. They tried to have a bill passed by the last Legislature compelling plumbers to be licensed, but it failed. The license system will prevent incompetent men from doing work, often apparently much cheaper than regular plumbers would do it for, but in reality much

This is the most useful and public-spirited work any master plumbers' association can engage in, and we wish them all success.

PHILADELPHIA TRADE SCHOOL.

OUR Philadelphia correspondent writes that a great deal of interest is being shown in the projected trade school of the Master Builders' Exchange of that city, and the men most interested in the scheme are congratulating them-

A committee of seven, representing different branches of the trade, have been appointed to secure the co-operation needed to make the movement a success.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ON PROPRIETY OF OMITTING TRAP FROM HOUSE-DRAIN CONNECTED WITH SMALL PIPE-SEWERS

CORNING WATER-WORKS, HEERMANS & LAWRENCE, Prop's. CORNING, N. Y., May 14, 1888.

SIR: We note your comments on our letter of inquiry SIR: We note your comments on our letter of inquiry in the issue of May 12 of your journal. To give you further details as to the construction of the "separate" system of sewers in Corning we state as follows: The main outlet sewer is 18-inch, about 2,300 feet, and other sizes are: 600 feet 15-inch; 2,200 feet 12-inch; 8,500 feet 10-inch; 9,500 feet 9-inch; 20,000 feet 8-inch; and 30,000 feet 6-inch. Manholes, with ventilated covers, are placed 250 feet apart on the entire system.

At the up-grade end of every line of sewers is placed a Van Vranken flush-tank, which discharges periodically. Four-fifths of the sewers have steep grades. A limited quantity of rain-water is admitted.

quantity of rain-water is admitted.

Now, as you seem to advocate in most cases a trap with fresh-air inlet, do you consider it proper to have this inlet open in the yard, as some authorities advise? What is the best practice?

Your answer to our first question as applicable to the Corning system will be appreciated by your readers here.
The question is, Should a trap be used on the main drain?
Very truly, HEERMANS & LAWRENCE.

[Under the circumstances stated, we are not prepared to advise that traps on the main drains should be insisted on. As we said in our former reply, which should be read in connection with this, this question depended largely on the condition and maintenance of the public sewers and house plumbing.]

THE DUTY OF NEW YORK PLUMBING INSPECTORS.

UTICA, N. Y., May 15, 1888.

SIR: Will you kindly tell me what are the duties of a plumbing inspector in New York City?

A. B. JOHNSON.

[The duty of an inspector is to see that all plumbing work is done in accordance with the plans filed with and approved by the Health Department for work done in his district and to report all violations.]

WANTED-A TELEPHONE PLANT.

RIDGEWAY, VA., May 17, 1888.

SIR: I have an interest in the construction of fourteen miles of the Roanoke and Southern Railroad, our miles of the Roanoke and Southern Railroad, our work extending from Martinsville, Va., to the North Carolina

Am anxious to establish telephone connections over the

fourteen miles.

Will you refer this to a good telephone company who
Will you refer this to a good telephone company who will you refer this to a good telephone company who will immediately quote me wire and instruments? Will buy or lease instruments for one year.

For prompt attention will oblige a subscriber to your valuable journal.

H. W. Newby,

Engineer and Contractor.

[The Southern Bell Telephone and Telegraph Co., 195 Broadway, New York, is the lincensee of the territory covering Ridgeway, Va.]

FORMULÆ FOR DYNAMITE AND ADDRESS OF PARTY SKILLED IN ITS MANUFACTURE.

RIDGEWAY, VA., May 21, 1888.

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SIR: Owing to the refusal of dynamite shipments by certain railroad companies, I am considering the practicability of mixing on the spot. Can you furnish the formulæ in general use and give me instructions as to methods? Also the address of some one skilled in the manufacture of Respectfully, H. W. NEWBY.

[From inquiries concerning this matter we find that rack-a-rock, a high explosive, claimed to be equivalent to dynamite that is 75 per cent. nitro-glycerine, can be shipped to any point in its separate parts and mixed as needed for use without danger or requiring skilled attendance. All railroads handle it willingly as shipped from the factory and charge the freight rates usual for chemicals. It is manufactured by the Rend-Rock Powder Company, of New York, whose card appears in our advertising columns.

The manufacture of dynamite in the field depends largely on the magnitude of the undertaking and probably would not be desirable for small quantities. The risk would naturally be greater than at established factories with experienced hands, and the initial outlay would be consid-



The difficulty lies in the manufacture of the nitro glycerine, which is the active component of dynamite, and probably would not be transported by any railroad. Its manufacture on the spot requires, besides the chemical and mechanical appliances, very thorough and extensive refrigerative apparatus, as it explodes if permitted to rise above a certain low temperature. Dynamite is prepared by simply mixing nitro-glycerine with pulp, charcoal, or earth, or any similar base that will absorb it and act as a vehicle.

Mr. Michael Brady, Rahway, N. J., would probably furnish a nitro-glycerine plant at moderate cost, and very likely send a man with it to take charge. An interesting account of some new European high explosives is given in our issue of April 28.]

STRENGTH OF CEMENT MORTAR.

BROOKLYN, May 11, 1888.

SIR. The article by Professor Baker in the issue of your paper for May 5 seems to contain some inexplicable errors in the percentages given in the second and third tables. In the second table the ultimate strength of piers ranges from 1,411 to 2,375 pounds per square inch; the brick are stated to have an average strength of 1,500 pounds per square inch; and yet the strength of piers is given in column 8 as only from 9 to 17 per cent. of the strength of the brick.

Similarly in the third table the strength of the brick ranges from 1,195 to 5,390 pounds per square inch, and the ultimate strength of the brick-work with the different mortars from 53 to 341 pounds only per square inch, vet the strength of the brick-work is said to be from 44 to 63 per cent. of that of the brick. It would seem in this latter table as if there were one too few figures in the amounts given for strength of brick-work. J. F. FLAGG.

THE NOMENCLATURE OF RAILROAD CURVES.

NEW YORK, May 3, 1888.

SIR: Please explain what is meant by a curve of 60° etc., and by a curve of 60° radius, — feet long as applied to railroad curves? Is a 60° curve one deflecting 60°? DRAFTSMAN.

The degree of curvature in railroads is designated by the length of the arc in degrees that is subtended by a chord of 100 feet. For instance, a "3° curve" is one in which 3° of arc is subtended by a 100-foot chord, or in which the radii to the extremities of a 100-foot chord make a central angle of 3°. The expression refers solely to the degree of curvature and has nothing to do with the length of the curve; thus, a "3" curve" may deflect 1" or 90", corresponding to a length of 33 feet or 3,000 feet respectively. The greatest curvature that can be thus designated is that of a "180° curve," whose radius would be 50 feet.

For ordinary curves, in which the arc of the 100-foot chord which subtends it are practically of the same length, the length of the radius is in exact inverse proportion to the degree of the curve. Thus, the radius of a "ro curve" is 5,730 feet; of a 2°, 2,865 feet; 3°, 1,910 feet; 5°, 1,146 feet, etc. Curves sharper than 1,000 feet radius, or say 6°, are avoided where possible on important roads. The limit of curvature on the West Shore Road as originally laid out was 4°, but in some places on the New York Elevated Roads curves of 90 feet radius are successfully used. They are "671/2" curves."

To answer your specific questions, we would say that "a curve of 60°" deflects 60°, no matter what its radius; what a "curve of 60° radius" may be we cannot conjecture, and certainly never heard of it as applied to railroad or any other curves. A "60° curve," as before stated, may deflect any amount, but for reasons above given it will always have a radius of 100 feet.]

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE date of the convention of 1888 at Milwaukee, Wis., will be the last week in June. Arrangements as to transportation are in progress with the passenger associations and committees, whereby it is expected that a rate of one and one-third full fare will be made for the round trip from all points on the lines of the roads represented by

Papers or discussions on papers already published are invited. A concise abstract of any paper to be presented should be sent to the secretary not later than May 31. This will make discussion more probable, as a copy of the abstract will be sent to members who may be expected to contribute discussion.

WESTERN SOCIETY OF ENGINEERS.

THE 247th meeting was held April 9 in Chicago, President A. Gottlieb in the chair, L. E. Cooley, Secretary. The memorial to Congress was amended to read as

"Whereas, The system under which our National Pub-lic Works is conducted is subject to severe and just criticism, being without a well-considered policy or a consistent pose," etc. 11. Beckler and John Herron resigned to join the

Montana Society of Civil Engineers

A communication was received from Mr. T. I. Nicholl. Vice-President and General Manager Natchez, Jackson and Columbus Railroad, accompanied by a letter from the Pennsylvania Steel Company, advocating the use of rails 33½ feet long, as standard, as cars are now 34 feet.

33½ feet long, as standard, as cars are now 34 reet.
The Committee on Highway Bridges, consisting of C. L.
Strobel, A. Gottlieb, and E. C. Carter, made the following

recommendations:

"We think that improvement in the character of highway bridges can be brought about by the following means:

"The Governor of each State to appoint an engineer, whose duty it shall be to examine and report on existing bridges, with authority to condemn unsafe structures, and to act as expert adviser to the Legislature on all questions and measures pertaining to the construction of new work.

"Cities and counties should be encouraged to employ engineers who are bridge specialists to prepare specifications and complete detail plans for bridges, and tenders from contractors should be received on the basis of these specifications and plans. In order to facilitate the adoption of this method, we think it highly desirable that engineers agree upon a scale of minimum rates for doing such work on a similar plan as in vogue among archite. ts.

"Inasmuch as we think it desirable that any action taken shall be, as far as possible, the joint action of all organizations similar to our own, we recommend, as a step preliminary to such joint action, that the Secretary be instructed to place himself in communication with other local engineering societies, and request from them an expression of opinion on the subject under consideration."

The report was referred back to the committee, with

The report was referred back to the committee, with instructions to correspond with other societies, with a view to an expression of opinion and ultimate co-operation.

ENGINEERS' CLUB OF PHILADELPHIA.

THE regular meeting of the club was held May 5, President Joseph M. Wilson in the chair, Howard Murphy, Secretary; thirty-four members present.

The secretary presented an illustrated description of a

rolling bridge for docks by Mr. Oscar Sanne, who says:
"During my stay with the Union Bridge Company I

was called upon to make a design for a rolling bridge to be used at the Government's Dock at Quebec, which was estimated to weigh 239,444 pounds,

"The bridge has to be moved back the full width of the channel, which is 69 feet 5 inches. The machinery is designed to open it in 2 minutes 54 seconds.

"All shapes are of steel, eye-bars and rods of iron

"This structure is to be built this spring and I hope

Mr. Robert A. Cummings presented, for the Reference Book, a table of equality of curves at different scales, by which a set of curve patterns cut for a certain scale can be

used for other scales.

Mr. M. R. Muckle, Jr., described a general and detail

arrangement for a system of underground conduits for electrical conductors, with numerous illustrations.

Mr. Henry G. Morris presented a number of specimens of Mitis metal castings, and an illustrated description of the furnace used in their manufacture.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met May 16, twenty-eight members and nine visitors present. The president being absent, Secretary William H. Bryan announced the resignation of George E. Otis, and the election of Colonel E. D. Meier as Vice-President, who then took the chair. William T. Gould was elected a member. Mr. Charles F. White read a paper on "The Failure of a Firmenich Boiler," which occurred at the Plant Flour Mills St. Louis. The construction of at the Plant Flour Mills, St. Louis. The construction of at the Plant Flour Mills, St. Louis. The construction of the boiler and the arrangement of the plant, together with the method of operation, were described. The material used was C. H. No. I iron of 45,000 pounds tensile strength. Test specimens had shown a tensile strength of from 50,100 to 58,900 pounds. The boiler had 3.375 square feet of heating surface and was rated at 225 horsesquare feet of heating surface and was rated at 225 norse-power. In the opinion of the speaker the failure was due to faulty design, which permitted great differences of tem-perature and consequent differences of expansion of ad-ioining tubes, as well as danger from scale. Messrs. joining tubes, as well as danger from scale. Messrs. Meier, Wheeler, Russell, Blaisdell, Nipher and Johnson

Meier, Wheeler, Russell, Blaisdell, Nipher and Johnson took part in the discussion.

The second paper was read by Mr. Louis Stockett on "A Well-Ventilated Mine." The proper ventilation of mines was such a simple matter that it was a cause for surprise that it was not better done. Mr. Stockett described in detail the arrangement at Mine No. 6, Staunton, Ill., illustrating his remarks with drawings. The difficulties met with and their remedies were with and difficulties met with and their remedies were since the state of

difficulties met with and their remedies were pointed out.

A report was then read from the committee to which was referred the matter of proposed legislation on National Public Works. They were of the opinion that the proposed legislation as laid down in the Cullom-Breckinridge bill is a step in the right direction, and recommended the appointment of one committee to raise funds as requested by the Executive Board by private subscription from members of the club and others, and another committee to correspond with similar committees from other clubs and with any persons who may be able to aid in bringing the merits of the proposed legislation to the attention of members of Congress. They were also of the opinion that promotion from the grade of Division Engineer to Depart-

ment Engineer should be subject to the recommendation of an examining board, and recommended that the club pass a resolution to this effect.

After discussion the report was adopted and the action required by its recommendations was made the special order for the next meeting, May 30, which will be the last of the spring session.

NEW ENGLAND WATER-WORKS ASSOCIA-TION.

THE seventh annual convention of this association will

be held at Providence, R. I., June 13, 14 and 15.

The following papers will be read and discussed: "Soils be held at Providence, R. I., June 13, 14 and 15.

The following papers will be read and discussed: "Soils from which supplies of water may be obtained by filter-galleries or driven wells," Phineas Ball, C. E., Worcester, Mass.; "Description of apparatus for notifying when high-water level is reached in reservoirs and water-tanks," W. P. Whittemore, Supt., North Attleboro, Mass.; "Microscopical sketches of some vegetable growths in reservoirs." F. F. Forbes, Supt., Brookline, Mass.; "The aeration of water-supplies by natural canals and low dams," S. E. Babcock, Chief Engineer, Little Falls, N. Y.; "Can tests by tubular wells be relied upon to show the amount of water that may be obtained for a public water-supply." W. C. Boyce, C. E., Worcester, Mass.; "The use of relief or safety-valves in distributing systems," S. E. Babcock, Chief Engineer, Little Falls, N. Y.; "Covered reservoirs," Charles H. Swan, C. E., Boston, Mass.; "Testing water-meters and some things learned thereby," L. Fred Rice, C. E., Boston, Mass.

Also the following topics will be discussed: What is the best way to limit the use and weight of special castings? What is the best method of locating gates and specials? What is the best method of locating gates and specials? What is the true value of pressure and recording gauges? Office routine—method of keeping accounts. What is the percentage of difference between the yield of driven wells at extreme seasons of the year?

Professor J. E. Denton, of the Stevens Institute of Technology, will illustrate with the stereopticon the

Professor J. E. Denton, of the Stevens Institute of Technology, will illustrate with the stereopticon the hydraulic problems involved in the construction of the new Croton Aqueduct and the methods of construction

Members of water boards and all others interested in questions pertaining to water-supply are always welcomed to the meetings of this association, and all persons eligible for membership are cordially invited to join it.

Edwin Darling, President, Pawtucket, R. I.; R. C. P. Coggeshall, Secretary, New Bedford, Mass.

Gas and Electricity.

Illuminating Power of Gas in New York City.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3							
Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Company.	Equitable Gas Light Company
May 19	24.86	20.83	22.15	30.41	29.27	24.58	32 . 34

CINCINNATI CIVIL ENGINEERS' SOCIAL CLUB.

THE civil and mechanical engineers of Cincinnati have organized an Engineers' Club, at the preliminary meeting thirty-two gentlemen being present. The officers for the current year are: Colonel William E. Merrill, U. S. Engineer Corps, President; Gustav Bouscaren, Vice-President; Russell Hindman, Secretary. The directors are G. B. Nicholson, A. L. Anderson, and J. Forster Crowell. The object of the club is to create social intercourse and friendly relations among the members. The meetings will be derelations among the members. The meetings will be devoted to discussions of matters pertaining to the science of engineering and reading papers on modern improvement and development.

AT a meeting of the Milwaukee members of the American Society of Civil Engineers in Milwaukee, the following committees were appointed to get ready for the annual convention of the American Society of Civil Engineers, which will be held in that city June 26, 27, 28 and 29: Finances—D. J. Whittemore, E. P. Allis, C. L. Colby, A. Conro, F. R. Finney, H. J. Hilbert. Arrangements—G. H. Benzenberg, S. A. Harrison, F. W. Kimball, O. Bates, E. J. Pœtsch.

W. C. KUTTER.

MR. W. C. KUTTER died suddenly of apoplexy at Berne' Switzerland, on the 6th inst. Mr. Kutter was the author who gave to the profession a formula for the flow of water in open channels which bears his name, and which is now very largely used by engineers. He was employed in the City Engineer's office at Berne, his position being that of principal assistant.

PERSONAL.

CIVIL ENGINEER ASSERSON, who has been in charge of the Yards and Docks Department and whose term of service at the Brooklyn Navy Yard expired on the 25th instant, has been detached, and Civil Engineer T. C. McCollum appointed in his place. Engineer Asserson will remain in charge of the construction of the Simpson



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

WILMINGTON, N. C.—Church.—Plans are wanted for a church, to cost from \$12,000 to \$15,000. No date specified. Address John W. Primrose as above.

RAWLINS, Wyo.—Penitentiary.—Plans are wanted here until June 5 for a Territorial Penitentiary to be erected here. Total cost of building to be \$100,000. For circular of instructions address James P. Wallace, Secretary Territorial Penitentiary Building Commission, as above.

WYOMING, O.—Sanitarium.—Plans are wanted here for a sanitarium to be erected on Findlay Heights, at Findlay, O. Address R. B. Latta as above.

FINDLAY, O.—Tabernacle.—Plaus are wanted here y the Good Templars for a tabernacle, to cost \$5,000. or details address Charles Williams, Assistant Cashier, armer's National Bank, as above.

Toledo, O.—Library Building—Plans are wanted here for a \$40,000 public library building. For details address C. A. Dresser, Chairman Building Committee, as above.

BUFFALO, N. Y.—Church.—Plans are wanted here for a church edifice to cost \$100,000, to replace 5t. Paul's Cathedral, recently destroyed by fire. For circular of instructions, etc., aderess Albert J. Barnard, of the Building Committee.



For works for which proposals are requested see also the "Proposal Column," pages i-vii-viii-368

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

LA SALLE, O.—Water.—The officials of this city advertise for a quantity of assorted pipe, also hydrants and other material. For complete details see our Proposal Columns

PASADENA, CAL.—Water.—It is said that the water companies of this place will substitute a 22-inch steel pipe line for the cement ditch now in use, which conveys the water to the consumers from the reservoir.

BRAUMONT, TEX.—Water.—Thomas & Gorman, water-works contractors, at this place, write as follows: "This city has just completed a system of water-works, which they have leased to a company, in concection with which this company intend erecting at once an electric light plant, 15 ton ice machine, refrigerator, steam laundry, telephone and fire alarm system, and desire machinery for the several plants. Information can be secured from Thomas & Gorman."

ABILENE, TEx.—Water.—Our correspondent writes as follows: "No steps have been taken to improve our water-works system."

BARRINGTON, R. I.—Water.—William Lawler, of the Drownville Water Co., at this place, writes as follows: "Our 'works' consist simply of a tank of 54,000 gallons capacity, on an elevation (105 feet), supplied by two iron turbine wind-mills from a large well some 2,600 feet away. We laid about 8,000 feet 4-inch Wyckoff pipe, and are to supply about forty dwellings, etc. Total cost, \$6,800. Estimated capacity, 10,000 gallons per day. David A. Waldron is president of he company.

he company.

TARENTUM, PA.—Water.—Concerning the improvements to be made to the water-works at this place, H.

M. Brackenridge, of Natrona, Pa., writes us as follows: "We will build a reservoir, 80 feet in diameter, 15 feet deep, to feet excavations, and 5 foot fill, besides doing other work and laying the following pipe: 11,800 feet 8-inch, weight, 48½ lbs.; 6,800 feet 6-inch, weight, 6½/2 lbs.; 4,280 feet 4-inch, weight, 10½ lbs.

Address all communications to me, at Natrona, Pa."

JEFFERSON CITY, Mo.—Water.—The officials of this city have granted a franchise to F. H. Binder for the construction of a system of water-works. For further details see our Proposal Columns.

SALT LAKE CITY, UTAH.—Water.—It is probable that the movement to establish a sewerage system for this city will give way for a while to a water-works project, which, the city officials think, should be settled first. The question of engaging an engineer to make investigations, etc., concerning the water supply, is now being discussed by them, and a meeting is to be held in a few days to take conclusive steps in the meeter.

WAKENBURG, Col..—Water.—It is reported that a system of water-works is to be constructed here and that details can be had by addressing Dr. T. F. Martin.

Bellevile, Kan.—The question of water-works is to be settled here at early day. Offers from numerous parties to purchase the franchise and erect a plant have already been made. So far, no definite steps have been taken.

LIGONIER, IND.—Water.—It is reported that the people of this place have voted in favor of establishing a system of water-works.

PLYMOUTH, IND.—Water.—It is reported that the people of this place have decided in favor of establishing a system of water-works.

HELENA, ARK.—Water.—It is probable that con-clusive steps will soon be taken towards the construc-tion of a water-works system here. Address the Town Clerk for details.

HEMPSTEAD, L. I.—Water.—The Auverne Water Company has been organized here with a capital of \$60,000. For details address C. E. Hoffman, as above.

SUTTON, NEB.—Water.—It is probable that a system of water-works will be creeted here soon. Complete details can be had by addressing Major Mattison of the City Council.

Ennis, Tex.—Water.—The water-works question is being agitated here.

WEATHERFORD, TEX.—Water.—It is reported that he erection of a water-works system at this place is to

HERINGTON, KAN.—Water.—An election is to be held here this month to settle the question of erecting a \$15,000 system of water-works.

GUTHRIE, Ky.-ls is reported that the Louisville and Nashville R. R. Co. will establish a water-works system here.

TROY, ALA.--Water.—A franchise for the construc-tion of a system of water-works here has been awarded to J. Walker Bates. It is reported that the supply will be obtained from attesian wells.

Youngstown, O.—Water.—The water-works trustees of this place have decided to extend the service by laying an additional trunk main, besides laying service pipes in several streets. Work is to begin at once. Details will be furnished by the clerk of the board as above.

OBERLIN, KAN. - Water. - Our correspondent writes: This place is to have water-works, to cost \$25,000.

A. A. Richardson, Engineer of Lincoln, Neb., is making the plans and specifications."

WATER-WORKS.—See our Proposal Column for information concerning water-works and water-works supplies at the following places: Welland, Ont.; La Salle, Ill.; Jefferson City, Mo.; Des Moines, Ia.; New York City; Cincinnati, O.; Atlanta, Ga

BRIDGES.

DES MOINES, IOWA.—It is reported that there is a project towards the erection of several bridges at this place, and that Charles Weitz can furnish details.

JACKSONVILLE, FLA.—Ammett F. Cook, of this city, can be addressed for details of a bridge scheme at Oxford, Fla.

PITTSBURG, PA.—It is reported that County Engineer Charles Davis can furnish details of 20 bridges to be erected in his county at a total cost of \$90,000.

RIVERTON, VA.—An iron bridge is to be erected over the Shenandoah at this place by the Shenandoah Val-ley Railroad Co. The company's office is at Roanoke, Va.

McKinney, Tex.—The county commissioners of Collin County, will, it is reported, rebuild the fourteen bridges recently destroyed by floods.

AKRON, N. Y .- It is reported that an iron bridge is to be erected here.

DUNLAP, TEX.—Two bridges are to be erected here the county commissioners, who can furnish details.

GAS AND ELECTRIC-LIGHTING.

WILMINGTON, N. C.—The Wilmington Gas Light Company has decided to increase its plant.

Annapolis, Mp.—The Annapolis Electric Light Co. expect to purchase the necessary material, etc., at once, to proceed with establishing a plant here.

BUFFALO, Wyo.—An electric light plant is to be established here.

HARRISONBURG, VA.—It is is probable that an electric light plant will be established here. For details, address Mr. Pace, at Washington, D. C.

MERIDIAN, MISS.—It is probable that an electric-light plant will soon be established here.

EAST PORTLAND, ORR.—The East Portland Lighting C mpany has been organized here with C. B. Bellinger at its head. Capital, \$130,000.

PATERSON, N. I.—An electric-lighting plant is to be rected here by the Paterson Electric Light Co. Dealls can be had of John Noonan.

DELAWARE, O.—The Delaware Edison Illuminating Co. has been incorporated here with a capital of \$50,500. B. W. Brown, and others, incorporators.

PROVINCETOWN, MASS.—A gas plant is to be established at this place.

Note.—The item published in this column last week stating that the city of Jacksonville, Fla., advertised for bids for electric lighting was erroneous in so far as the name of the city was concerned. Jackson, Miss, was the place intended. See our Proposal Column on page 368 for corrected proposal.

FLUSHING, L. I.—The Equitable Gas Light Company has been incorporated here with a capital of \$50,000. The directors have applied to the village trustees for permission to lay mains, establish a plant, and furnish has to consumers, but as yet the permission has not been granted. For details address Frank Keeler, of the Board of Trustees, as above.

RAILROADS, CANALS, ETC.

CLINTON, MO.—A franchise has just been granted to the Clinton Street R. R. Co., to build a street line here.

ERIE, PA.—A street railroad is to be constructed here as soon as details can be settled.

Modesta, Col.-A street roailroad is to be con-

structed here this season.

ST.CATHERINES,ONT.—Messis. James A. McMahon, W. M. Shea and George A. Begy, of this place, have been awarded 17 miles of Grand Trunk double-track work from Coteau to Lancaster, near Montreal. The amount of the work is about \$150,000.

New York City.—The scheme to build an elevated railroad on Broadway, this city, has had a setback in the reversal by the General Term of Judge Donahue's order appointing commissioners to appraise value or right of way. It is proposed to carry the matter to the Court of Appeals.

BIDS OPENED.

right of way. It is proposed to carry the matter to the Court of Appeals.

BIDS OPENED.

CLARKSBURG, W. VA.—Water-works.—The following proposals for the construction of a system of water-works at this place were opened May 15 by John W. Hill, Cincinnatt, O., Consulting Engineer:

Water-Pipe and Special Castings.—Donaldson Iron Co., Emaus, Pa., \$17,307.51; New Philadelphia Pipe Works, \$18.058.50; R. D. Wood & Co., \$18,181.20; J. H. Harlow & Cc., \$18,242.10; James J. Dwyer, \$18,272.20; Mellert Foundry Co., \$18,145.00; Addyston Fipe and Steel Co., \$18,445; Lake Shore Foundry Co., \$18.670.45; John Fox, \$18,455.32; Hugh H. Davis, \$18,561; National Foundry and Pipe Works, \$18,860.10; Chattanoga Pipe Works, \$18,621; Detroit Pipe Co., \$19,449.35; Gloucester Iron Works, \$20,271.34; Dennis Long & Co., \$20,449.20; H. B. Leach, specials only, \$576; J. S. Cassin & Co., specials only, \$576; J. S. Cassin & Co., specials only, \$576; J. S. Cassin & Co., \$464.50; James J. Dwyer, \$456; Eddy Valve Co., \$464.50; James J. Dwyer, \$456; Eddy Valve Co., \$474.95; Bourbon Copper and Brass Works, \$477.50; W. S. Payne & Co., \$480.45; Ludlow Valve Co., \$468.64; Chapman Valve Co., \$517.48; Mellert Foundry and Machine Co., \$520; R. D. Wood & Co., \$221.05; James H. Harlow & Co., \$567; Jonson Foundry Co., \$614.50; Gloucester Iron Works, \$655. Contract awarded to Eddy Valve Co.

Fire Hydrants.—James J. Dwyer, \$1,598.50, \$1,431; Bourbon Copper and Brass Works, \$1,472.50, \$1,482, \$1,513; H. B. Leach, \$1,482; Chapman Valve Co., \$1,507.30; J. H. Harlow & Co., \$1,677.80; Gloucester Iron Works, \$1,790.50; Eddy Valve Co., \$1,507.20; J. H. Harlow & Co., \$1,677.80; Gloucester Iron Works, \$1,790.50; Eddy Valve Co., \$1,507.20; J. Dwyer, \$1,500.50; J. H. Harlow & Co., \$1,677.80; Gloucester Iron Works, \$1,770; Deane Steam Pump Co., \$4,360; A. C. Osborn, Worthington pump, \$4,720, Deane Pump, \$4,770; Deane Steam Pump Co., \$4,360; A. C. Osborn, Worthington pump, \$4,720; Deane Pump, \$4,770; Deane Steam Pump Co., \$6,250; National Iron Works, \$6,500; H. H. Leach,

Morrison.

Louisville, Ky.—Water-Works Materials.—The following bids for the erection of a new pumping station for the Louisville Water-Works Company were opened by the Board of Directors of the Company May 15: Mr. McDonald, caisson, \$114,000; masconry, \$16,40 per cubic yard; brick, \$13 per thousand; sills, \$1.40 per foot; croping, \$1.40 per foot; granite, \$4.75 per foot; setting irons, \$4 per ton; pointing, 6 cents per ton, and new crib, \$16,800. Sooy, Smith & Co., caisson, \$112,000; masonry, \$16.50 per yard; brick, \$14.50 per thousand; sills, \$1.50 per foot; coping, \$1.30 per foot; granite, \$5 per foot; pointing, to cents per ton, and crib, \$17,400. Shanshan, O'Connor & Co., caisson, \$125,000; masonry, \$12 per yard; brick, \$16 per thousaud; sills, \$1.50 per foot; coping, \$1.50 per foot; granite, \$4.50 per foot; setting irons, \$5 per ton; pointing, 5 cents per ton, and crib, \$18,000. The bids were all considered too high, and the Board decided to have the work done under the management of the company.

NEW BRUNSWICK, N. J.—Building Dam.—The following proposals for building a water-works dam at this place were opened May 21 by C. H. Cramer, water-works superintendent. The estimated quantities were as follows: Foundations, 325 cubic yards; dam and abutments, 644 cubic vards; coping, 800 square feet. Bidders: P. H. Rehill, Jeisey Citv, \$14,100; B. J. Bailey, New York, \$13,075; J. E. Brooks, New York, \$10,062.50; John Cox, Brooklyn, N. Y., \$14,813.75; F. W. Sullivan, Newark, N. J., \$0,595; B. M. & J. F. Shanley, Jersey City, \$8,716.25; John Meyer, New Brunswick, N. J., \$12,600; Bell & Dunham, \$10,000. Contract swarded to Shanley.

Dunham, \$10,000. Contract swarded to Shanley.

MINNEAPOLIS, MINN.—Pumping station.—The following bids have been submitted to the City Council for the North Minneapolis pumping station: M. H. Chittenden, slate roofing, per square, \$10.50; steel roofing, \$5.75; ion, tin, etc., \$12.90. Grygla & Seldon, slate roofing, per square, \$10.25; steel roofing, \$5.50; iron, tin, etc., \$15.50. Robert Wishart, slate roofing, per square, \$10.25; steel, \$5.50; iron, tin. etc., \$12.50. The contract was awarded to Robert Wishart.

ROSTON MASS —Works for Chamical Treatment of

contract was awarded to Robert Wishart.

BOSTON, MASS.—Works for Chemical Treatment of Sewage.—The following proposals for erecting works for the chemical treatment of sewage at Winchester, Mass., were opened May 19, by the Boston Water Board. The quantities, etc., were as follows: Four

precipitation tanks, engine-house, auxiliary building, precipitation tanks, engine-house, auxiliary building, 850 cubic yards excavation, 75 cubic yards brick masoniy, 73 cubic yards concrete. The following were the bidders with the amounts in their respective order: Joseph Ross, Ipswich, Mass., \$3,252, \$1,266, \$577. \$722.50, \$1,200, \$78; total, \$7,095.50; John McLaren, Boston, Mass., \$3,760, \$4,360, \$845, \$637.50, \$1,200, \$0,7.50; total, \$7,000; \$5. Sanborn, Boston, Mass., \$2,900, \$2,125, \$1 025, \$1,062.50, \$1,087.50, \$65; total, \$0,165; W. H. Keyes & Co., Boston, Mass., \$4,149.50, \$2,345, \$1,124.75, \$680, \$1,125, \$84,50; total, \$9,508.75. The contract was awarded to Joseph Ross.

\$9,165; W. H. Keyes & Co., Boston, Mass., \$4,149.50, \$2,345, \$1,124.75, \$680, \$1,125, \$84.50; total, \$0,508.75. The contract was awarded to Joseph Ross.

ST PAUL, MINN.—Reformatory Building.—The following proposals for the erection of the Minnesota State Reformatory were opened May 15 by J. W. Stevens, architect:

Stone and Masonry and Excavation—William O'N rel and C. O'Brien, Faribault, \$21,675; Carlisle & Sons, Minneapolis, \$42,087; J. L. Bjorkquist, Moorhead, \$44,500; M. Breen, St. Paul, \$46,669.85; Walter Arnold & Co., St. Cloud, sandstone, \$48,150, grante, \$40,275; R. E. Patterson, Agt., St. Paul, carpenter work, \$54,000; Oscar Ludlum, Minneapolis, \$55,650; Hennessee Bros., Agnew & Cox, St. Paul, \$55,750. Contract awarded to Carlisle & Sons.

Carpenter Work—G. W. Smith, Minneapolis, \$55,750. Carlisle & Sons, Minneapolis, \$7,300; William Letteau, St. Paul, \$9,696. Contract awarded to G. W. Smith. Iron Work—Haugh, Ketcham & Co., Indianapolis, \$23,437; St. Paul Foundry Co., St. Paul, \$24,193. Clark, Raffen & Co., Chicago, \$24,600. Contract awarded to Haugh, Ketcham & Co.

Plumbing.—A. J. Kinslow, Brainerd, \$3,885; J. P. Adamson, St. Paul, \$4,480; W. W. Sykes & Co., Minneapolis, \$4,600; I. T. Holmes, St. Paul, \$3,300; E. P. Adamson, St. Paul, \$3,295,44; Thomas Davis, St. Paul, \$3,300; Allen Black & Co., St. Paul, \$3,300; E. F. Osbora & Co., St. Paul, \$3,295,44; Thomas Davis, St. Paul, \$3,300; Allen Black & Co., St. Paul, \$3,300; E. F. Osbora & Co., St. Paul, \$3,295,44; Thomas Davis, St. Paul, \$3,300; Allen Black & Co., St. Paul, \$3,300; C. F. Paul, \$3,300; Allen Black & Co., St. Paul, \$3,300; C. F. Paul, \$3,300; Allen Black & Co., St. Paul, \$3,300; C. F. Paul, \$3,300; St. Paul, \$3,300; St. Paul, \$3,300; St. Paul, \$3,300; St. Paul, \$3,300; C. Contract awarded to George Winding, Milwaukee, \$1,710. Contract awarded to George Winding, Milwaukee, \$1,710. Contract awarded to George Winding, Milwaukee, \$1,710. Contract awarded to George Winding, Milwaukee, \$1,710. Contract awarded to St. Paul, \$5,745; C. Contract aw

**JSO. \$15.000, \$200, \$4.000, \$500, \$1.200, \$7.200, \$7.200, \$1.200, \$2.000, \$1.200, \$7

tract was awarded to Houbens & Shelton.

ST. CLOUD, MINN.—New bids for constructing the reformatory, at this place, have been opened. The successful bidders were as follows:

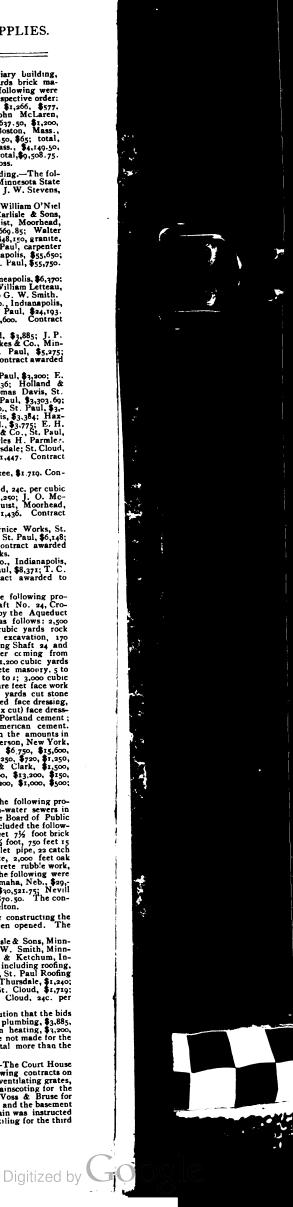
Brick and stone-work, James Carlisle & Sons, Minneapolis, \$42,087; carpenter work, G. W. Smith, Minneapolis, \$6,270; iron cell work, Hall & Ketchum, Indianapolis, \$7,074; other iron work, including roofing, same parties, \$23,437; slate roofing, St. Paul Roofing Works, \$5,194; painting, Hussey & Thursdale, \$1,240; asphalt flooring, George Windig, St. Cloud, \$1,739; excavating, N. Anderson, East St. Cloud, 24c. per yard.

yard.

The managers have passed a resolution that the bids of H. A. Kingston, Brainerd, for plumbing, \$3,885, and C. H. Parmlee, St. Paul, steam heating, \$1,200, were the lowest, but the awards were not made for the reason that they would make the total more than the appropriation available this year.

appropriation available this year.

St. Paul, Minn.—Court House.—The Court House Commission has awarded the following contracts on the new court house building: For ventilating grates, to J. T. Tostevin & Son; marble wainscoting for the first and second stories, to Grant, Voss & Bruse for \$47,358. All bids for the third story and the basement were rejected. County Auditor Kain was instructed to advertise for bids for encaustic tiling for the third story and basement.



GOVERNMENT WORK.

OWENSBOROUGH, KY.—Post Office.—The following proposals for the erection of a post office at this place were opened May 18 by the Supervising Architect of the Treasury Department:

John O'Connor, \$39,970; John Mitchell, \$46,310; Dumesneil Bros., \$31,042; McCarthy & Baldwin, \$37,818; G. W. Corbett, \$35,000; James H. Costen, \$42,222; Thomas & Driscoll, \$47,500.

LOUISVILLE, KY.—Iron Roof, etc.—The following proposals for the iron roof of the court house here, including terra cotta and concrete covering, copper work, glazing, stairs, and floors in tower, etc., were opened May 21 by the Supervising Architect of the Treasury Department:

Snead & Co., \$110,600; Haugh, Ketcham & Co., \$113,445.

MINNEAPOLIS, MINN.—Plumbing and Gas Fitting.—
The following proposals for the plumbing and gas
fitting, complete, in the post office here were opened
May 22 by the Supervising Architect of the Treasury
Department:
W. W. Sykes & Co., \$8.170; J. F. Dalton, \$5,235;
Crook, Horner & Co., \$5,793.70.

W. W. Sykes & Co., \$8,170; J. F. Dalton, \$5,235; Crook, Horner & Co., \$5,793.70.

Reading, Pa. — Post-Office. — The following proposals for the erection of the post-office at this place, exclusive of the masonry, to top of water-table; the heating apparatus, and the completion of the approaches, were opened May 17 by the Supervising Architect of the Treasury Department: Anderson Brothers, stone, Berea Amherst, \$74,860; Amherst, \$77,860; buff limestone, \$79,780; blue limestone, \$83,-000; Hummelstown brownstone, \$82,000; Concord, N. H., granite, \$106,000. Levi H. Focht, Ohio blue, \$103,000; Vermont marble, \$112,000; Indiana limestone, \$107,000; Hummelstown sandstone, \$107,000. McCarthy & Baldwin, Ohio blue and Reading pressed bricks, \$90,178; Ohio blue and Pennsylvania pressed brick, \$90,178; Ohio buff, and Pennsylvania pressed brick, \$94,114; Hummelstown and Pernsylvania pressed brick, \$94,114; Hummelstown and Pernsylvania pressed brick, \$04,114; Hummelstown and Pernsylvania pressed brick, \$101,383. D. & W. C. Kutz & Co., Ohio blue, \$101,655; Indiana limestone, \$110,155; Hummelstown blue, \$110,155. Herman F. L Rummil, Ohio blue, \$107,463; Ohio buff, \$109,403; Hummelstown brown, \$111,476; Indiana lime, \$111,476; Vermont marble, \$116,513.

MINNEAPOLIS, MINN.—Interior Finish.—The following proposals for the interior finish of the post office here, including roof covering, floor arches, copper and iron work, painting, glazing, hardware, etc., were opened May 22 by the Supervising Architect of the Treasury Department:

E. F. Gobel, \$153,613, all work; Hennessy Bros., Agnew & Co., \$188,085, all work; Farnham Marble and Mantel Co., \$17,526, for marble work only; Grant, Voss & Breese, \$16,757, for marble work only.

Voss & Breese, \$16,757, for marble work only.

Des Moines, Iowa.—Court House.—The following proposals for roof covering, including terra cotta roof tile and arches and iron drains and copper and slate work, complete, were opened May 10 by the Supervising Architect of the Treasury Department:

L. G. Compaut, Des Moines, \$11,949.20; Willard Baker & Co., Rockland, \$5,754.85; Albert L. West, Des Moines, \$9,500. In addition to 6,000 slate and 13,000 square feet of 2-inch terra cotta tile now supposed to be on hand at the building.

NEBRASKA CITY, NEB.—Interior Finish.—The following proposals for the interior finish of the court house here were opened May 22 by the Supervising Architect of the Treasury Department:

Thomas & Driscoll. oak finish, \$29,600, cypress finish, \$27,800; George W. Corbett, oak, \$21,785, cypress, \$29,085; McCarthy & Baldwin, oak, \$28,900. cypress, \$76,000; Harry Wales, \$24,793, cypress, \$26,900; Harry Wales, \$24,793, cypress, \$22,787; John Myers & Son, oak, \$24,409, John O'Connor, oak, \$40,359, cypress, \$30,859; Fibert Mitchell Fur. Co., oak, \$23,988.95.

MISCELLANEOUS.

MISCELLANEOUS.

ALBANY, N. Y.—The Governor has signed the bill appropriating \$30,000 for dredging the Eric Basin, Hamburg Canal, Ohio Basin, and Black Rock Harbor in Buffalo.

PROPOSALS.

(Continued from page viii.)

MAY 24, 1888.

SEALED PROPOSALS will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 20 clock P. M. on the 14th day of June, 1888, for the labor and materials required in the completion of the Court-House and Post-Office at Des Moines, Ia., (fire proofing, plastering, joinery and all interior finish included, except the heating appartus) in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Builders' Exchanges Cincinnati, O., Detroit, Mich., Indianapolis, Ind.; the Builders' and Traders' Exchanges at Louisville, Ky., and Kansas City, Mo.; the Institute of Building Aits, at Chicago., Ill., and 'the North Western Permanent Exhibit at Minneapolis, Minn. Each bid must be accompanied by a certified check for \$1,000. VILL. A. FRERET, Supervising Architect. SEALED PROPOSALS will be received at the office

ELECTRIC LIGHTS, Jackson, Miss.—Proposals are wanted until July 1, for electric lights, the plant to be owned and operated by the contractor, the city to take 30 arc lights; works to be in operation by October 1, 1888. Address William Henry, Mayor, as above.

SCHOOL, Cincinnati, O.—Proposals are wanted until June 4, for the erection of a school building, according to specifications. Address George Emig, Chairman Committee on Buildings and Repairs.

PIPE, Welland, Ontario.—Proposals are wanted for 500 feet flexible joint pipe, eight inches in diameter, to be used in crossing under the Welland Canal. No date specified. Address John F. Gross, Secretary Water-Works Committee, as above.

PIPE LAYING, Indianapolis, Ind.- Proposals are wanted for laying about eighteen miles high-pressure city gas-mains. No date specified. Address W H. Schockleton, Superintendent Consumers' Gas Trust Co., as above.

PIPE, La Salle, Ill.—Proposals are wanted until June 5, for a quantity of vitrified and water-pipe, also hydrant and valves. Address Mayor F. W. Matthiesen, as above.

PROPOSALS.

ROOF, Longview, O.—Proposals are wanted until June 2, for the erection of a roof over portico, at Insane Asylum. Address Frederick Raine, Auditor, Hamilton County, as above.

STEAM HEATING, Washington, D. C.—Proposals are wanted until June 1, for furnishing steam heating apparatus for the old Army Medical Museum Building and annex in this city. Address C. H. Hoyt, Assistant Quartermaster, U. S. Army, as

CEMENT, SAND AND STONE, Washington, CEMENT, SAND AND STONE. Washington, D. C.—Proposals are wanted until June 2, for furnishing so much natural hydraulic cement, sand and broken stone as may be required and ordered for the Congressional Library Building, in this city, estimated as probably about 5,000 barrels of cement, 1,600 cubic yards of sand, and 400 cubic yards of broken stone. Address William F. Vilas, Office of the Commission for the Construction of the Congressional Library Building, as above.

COURT HOUSE, Danville, Va.—Proposals are wanted until June 15 for the interior finish, plastering, joiner-work, etc., for the court house at this place. Address T. R. McDearman, as above.

BUILDING, Washington, D. C.—Proposals are wanted, until June 6, for the erection, including materials, for an extension to the East Lodge of the Government Hospital for the Insane, near Washington. Address William F. Vilas, Secretary, Department of the Interior.

TIMBER, Cincinnati, O.—Proposals are wanted until June 15, for furnishing and delivering 37,102 feet B. M., of white oak timber for gates and mitre sills of Lock No. 8, Monongahela River. Address William E. Merrill, Leut.-Col. of Engineers, as

PUBLIC BUILDINGS, Newport, Ky,-Proposals are wanted until June 25 for the construction of the following described buildings of brick and stone, viz.: One quarter for commanding officer, two barracks, four sets officers' quarters, one Quartermaster's and Commissiary store-house, one bake-house, three sets non-commissioned staff quarters. All to be erected near this place. Address A. H. Young, Captain and Assistant Quartermaster, U. S. Army, as above.

SCHOOL, New Haven, Conn.—Proposals are wanted until June 1, for the erection of a school building at this place, according to specifications. Address H. H. Strong, Chairman of the Committee on School Buildings, as above.

BUILDING, Quincy, III.—Proposals are wanted until May 31, for the erection of several buildings, complete with plumbing, heating apparatus, etc., for Soldiers' Home at this place. Address D. Dustin, of the Board of Trustees, as above.

HEATING AND VENTILATING, Moorhead, Minn.-- Proposals are wanted until June 9 for heating and ventilating the State Normal School at this place, according to specifications. Address C. C. Kurtz, of the Building Committee, as above.

SCHOOL, Sandusky, O.—Proposals are wanted until June 2 for the erection of a brick school building, according to specifications. Address J. L. Green, Clerk of the Board of Education, as above.

STAND-PIPE, Jefferson City, Mo.—Proposals are wanted until May 30 for furnishing complete a steel water-tower stand-pipe, according to specifications. Address F. H. Binder, President Water-Works, as

SEWERS, Des Moines, Ia —Proposals are wanted until June 4 for the construction of sewers in certain streets. Address Charles Bennett, City Engineer, as above.

STFAM HEATING, Fremont, O.—Proposals are wanted until June 5 for the steam heating of and the erection of a laundry and boiler house to the County Infimmary building at this place. Address S. B. Suyder, Auditor of Sandusky County, as above.

IRON BRIDGES, Bradford, Pa.—Proposals are wanted until June 4 for the erection of two sidewalk wanted until June 4 for the erection of two sidewalk bridges, according to spectifications. Address John A. Seymour, City Clerk, as above.

Building Intelligence.

s 64th st, 97 e Av A, br malthouse brewery; cost, ooo; o, H W Schmidt; a, Weber & Drosser.

\$45,000; 0, H W Schmidt; a, weber a 2005. Es Morris av, 42 n 157th, 3 br tens; cost, \$30,000; 0, Theo Wegener; a, F S Barnes.

530 Courtlandt, br ten and store: cost, \$12,000; o, Michael Eckes; a, Wm Kuschee. 3-5 Harrison, br store; cost, \$10,000; 0, Chas West, a, M V B Ferdon,

251 Walker, br ten; cost, \$12,000; o, John N Eckl; a, Carl F Eisenach.

44 Gold, br store; cost, \$15,000; o, J Lager; a, B E Lowe.

Se cor 143d and Willis av, 2 br stores and tens; cost, \$30,000 all; o, T Rohrt; a, H L Peters.

Ws W st, foot of Beach, fron shed; cost, \$7,500; o, Old Dom. fon S Co; a, R P Staats.

S w cor y'h av and 76th st, br flats and stores; cost, \$60,000; o, Lawrence Kelly; a, C A French & Co.

S e cor Thames and Green wich, br factory and offices; cost, \$250,000; o, Western Electric Co; a, C L W Eidlitz.

38 Pine, br office bldg; cost, \$20,000; o, Northern Assurance Co of London; a, J B Snook & Sons.

W s Eighth av, 208 n 82d, br flat; cost, \$19,000; o, E Purcell; a, Thom & Wilson.

321 E roth, br flat; cost, \$20,000; o, Emma J Mason; a, B E Lowe.

322 E 27th st, one br flat; cost, \$18,000; o, T Pearson; a, N Le Brun & Son.

112th st, n s, 66 e 3d av, r br flat; cost, \$24,000; o, H Maseman; n, Thom & Wilson.

BUILDING INTELLIGENCE.

NEW YORK CITY-Continued.

98th st, s s, 100 w 2d av, 5 br flats: cost,\$15,000 each; o, A B Edwards; a, C Baxter.

Lexington av. n. w cor 89th st, 6 br dws; cost, \$9,000 each; o, estate of W C Rhinelander; a, H J Hardenbergh; b'rs, McCabe Bros.
124th st, s s 64 w 3d av. 1 flat and store; cost, \$24,-000; o, J M Hyde; a, J Henderson.

122d st, n s, 221 w 3d av, 1 br stable; cost, \$20,000, o, Sarah and G W Freeborn; a, Cleverdon & Putzel. 77th st, n e cor 10th av, t br scoool-house; cost. \$120,000; 0. Mayor, Aldermen, etc.; a. G. W. Debeyoise. 95th st, s s, 150 w 8th av, 4 br dws; total cost, \$45,-

108th st, n w cor 12th av, 1 fr shed; cost, \$7,000; o, Mayor, Aldermen, etc; a, Lederle & Co.

ALTERATIONS-NEW YORK.

10 and 12 East 16th, br extension; cost, \$40,000; o, J H V Cockroft; a, G E Harding.

S s 64th, 214 e Av A; cost, \$10,000; o, H W Schmidt; a, Weber & Drosser.

S s 133d, 250 e Convent av. br extension; cost, \$40,000; 0, barah Jones; a, R S Townsend.

39th st, n s, 61 w 10th av, internal alterations; cost,
\$12,000; 0; D. Stevenson; a, Thom & Wilson.

77, 79 and 81 Cedar st, internal alterations; cost, \$6,500; 0, J B Kinney; a, Q N Evans.

368 Washington st, walls altered; cost, \$10,000; 0, H Dickmann; a, Kurtzer & Rohl.

H Dickmann; a, Kurtzer & Rohl.
63 Clinton pl, 4-story br extension; cost. \$8,000; o, C L Vath, a, Kurtzer & Rohl; b'rs, J Shaeffer & Son. 30 W 4th st, brextension; cost, \$10,000, 0, H Brash; a, Cleverdon & Putzel.

BROOKLYN.

695 Bergen st, br dw; cost, \$35,000; o, M M Donald;

N s 5th st, 400 e 5th av, 5 br dws; cost all, \$37,500; o, Louis Bonent; a, Geo Damen

Es Bond st, 100 s Union, frame coal pocket; cost, \$8,000; o and a, Thos H Lidford

N s Fulton av, 394 w Tompkins av, 4 br dws and stores; cost all, \$48,000; o, J O Prich; a, Amzi Hill N s Palmetto st, 160 e Broadway, 2 br dws; cost all 8,000; o, W Barton; a, J E Dwyer

Ss Schaeffer st, 175 e Broadway, 3 fr dws; cost all, 5,000; o, F Siering; a, H Vollweiller N's Palmetto st, 200 e Broadway, 3 br dws; cost all, \$15,000; 0, Wm Barton; a, J E Dwyer

MISCELLANEOUS.

BOSTON, MASS.—Huntington av and Gainsborough st. 4 brick apartment houses; cost \$80,000, 0, Seth R Baker; a, Henry W Savage; b, A Xavier.

St Botolph and Gainsborough sts, 4 br dws; cost, \$50,000; 0, Seth R Baker; a Henry W Savage; b, A Xavier.

5 Brimmer st, 1 br apartments; cost, \$20,000; o, Seth R Baker: a, Henry W Savage; b, A Xavier. 467 Beacon, 1 br dw, cost, \$12,000; o, A H Caton; a, J H Besarick; b, A H Caton.

Broadway, extention, r br tenement; cost, \$14,000 o, John F Noonan; a, W Glynn; b, W Glynn.

N Charles st, 1 br hospital ward; cost, \$8,000; 6, Maj-Gen Hafp; a, Carl Fehmer; b, D Connery & Co.

LOWELL, MASS.—6th, 3 story fr parochial school bldg, 50x60; b, not let.

FITCHBURG, MASS.—Stone and br jail addition; \$65,000 appropriated; b, Staples Bros, Lowell, Mass LAWRENCE, MASS.-4 story br mill, 139x100; o, Arlington Mill Co; b, not let.

2 story brick mill, 259x50; o, Arlington Mill Co; b, not let.

4 story br mill, 400x100; o, Pacific Mill Co; b, not let

HOOSICK FALLS, N Y—Armory, to cost \$70,000; J G Perry, architect, N Y

SIOUX CITY, IOWA-415-17 Fifth street, addn to Hotel Garretson; cost, \$16,000; o, Joy & Marks; a, E Loft; b, F F Beck

501-3 Fourth st, business block; cost, \$20,000; o, N Despaior; a, C P Brown; b, not let

MANCHESTER, N H-Wood dw; cost, \$15,000; o, Ben Deane; a, F W Stickney; b, Head and Dowst

CRETE, NEB. -A high school is to be erected here at a cost of \$25,000. For details address H H Skinner, as above

ST. PAUL, MINN.—The Messrs Endicott, of Boston, will probably erect a Builders' Exchange here, to be filled with offices of architects, builders, contractors, and supplymen.

MILWAUKEE.—South Pierce st, block of dws; cost, \$11,500; 0, Chas F & John L Burnham.

Cor 2nd and Fowler sts, br store, 90x102; cost, \$12,000; 0, Swift & Co (of Chicago).

S e cor of Marshall and Ogden sts, br and stone church; cost, \$40,000; o, 1st Baptist Church Society. North Greenfield, fr church; cost, \$7,000; 0, Methodist Church Extension Society.

Prospect ave, br and st dwell; cost, \$70,000; o, David M. Benjamin & Co., of Pittsburg. Milwaukee st, br store; cost, \$9,000; o, Jos Schlitz Brewing Co.

Cor Farwell and North av, br add to car barn; cost, \$10,000; 0, Cream City Railway Co.

Cor Center and 3rd sts, 2 br stores; cost, \$7,000; 0, Philip Gaubetz.

Cor Buffalo and E Water streets, br add to store; cost, \$7,000; 0, Goll & Frank Co. 5th st, near Fowler, br warehouse, cost, \$7,000; o, Davidson & Sons.

Cor 6th and Lee sts, br dwell; cost, \$7,000; o, L. W. Vizay. Cor Brady and Racine sts, br store, cost, \$8,000; o, F Trzebeatowski.

Thirty-two buildings, less than \$5,000.

BUILDING INTELLIGENCE.

MAY 26

PEORIA, ILL.—A new edifice is to be erected by the congregation of St. Paul's Church at a cost of \$20,000

READING, PA.—St. Matthew's Lutheran gation will erect a \$30,000 edifice. For d dress Rev. D. Billheimer at this place

NEWARK, N. J.—The Methodists of this place will erect a \$60,000 church and parsonage

OTTAWA, KAN.—A \$30,000 church is to be erected here. For details address Mr. Hendrickson, as above.

SOUTH NORWALK, CONN.—A \$60,000 church is to be erected here by the Congregational church society

PITTSBURG, PA.—Bldgs, at a cost of \$500,000, are to be erected here. For details address J F Draw, President Chamb r of Commerce. SOUTHBRIDGE, MASS.—The Y M C A of this place will erect a building to cost about \$50,000.

PITTSBURG, PA.—Architects Biskle and Brennan have prepared plans for a \$60,000 building to be erected at this place.

SPRINGFIELD, MASS.—An opera house is to be erected here at a cost of \$100,000. For details address J A Rumrill, as above.

GREENFIELD, MASS.—Brick stock house, 50 feet square, 2 stories, fire proof; o, Wiley and Russell Safe Co; b, Charles D Shaw.

HURON, D. T.—Packing house; cost, \$10,000; o, Dakota Packing and Provision Co.

TACONY, PA.:-Rolling mill; cost, \$100,000; o, Disston Rolling Mill Co.

CLEVELAND, O .- Long and Champlain, br factory: cost, \$25,000; o, Hitchcock & Perrins estate of Warren, O.

ST. CATHERINES, ONT.—Brewery; cost, \$20 .000; o, Taylor & Bates. LYNN, MASS.—The plans for a \$150,000 high school building have been prepared by E L Rogers of this city.

MONTCLAIR, N. J.—A residence, to cost \$13.000, is to be erected by Mrs J S Benedict. S M Hoiden, architect.

PASSAIC, N. J.—J S Anderson will build a \$7,000 residence here. S M Holden, architect.

ST. PAUL, MINN.—The directors of the Germana bank have accepted Architect Stevens' drawings for the new bank building. The structure will be fire-proof throughout and will cost in the neighborhood

BRISTOL, TENN.—The Bristol Land and Improvement Company will erect a \$20,000 hotel at this

SAN FRANCISCO, CAL.—Plans are being prepared by J M Curtuss for the erection of a \$30,000 hotel at Chicago Park, Cal.

ROCHESTER, N. Y.—The Y M C A will commence work shortly on its building, to be erected at a cost of \$125,000.

TORONTO, CAN.—A school is to be erected here by the school board at a cost of \$20,000. ST. LOUIS, MO.--Brick church; cost, \$9,300; o, St Iacob's Church; b. W H Balmer

Br factory; cost, \$27,000; 0, Quick Meal Stove Co; b, F C Bonsack

Br addn; cost, \$18,000; o, Home of Friendless; b, sub let Br dw; cost, \$7,000; o. Mrs H Vickery; b, H Vickery

3 br dws; cost, \$8,000; o, Wm Doerbeck; b, P Riechers 3 br dws; cost, \$9,500; o, Emily and Rose Young; a, A Uhri & Son

KALAMAZOO, MICH.—The Congregational Church Society will erect a stone church to cost \$40,000, for which plans are now being prepared by Mr Sidney J Osgood, architect, of Grand Rapids, Mich

WEST SUPERIOR, WIS.—A joint company, the Lehigh Transportation Company, the Lend and River Improvement Company and the North-western. Fuel Company, the two latter of West Superior, will construct the largest combined coal and merchandise dock on the chain of lakes. It will have a capacity for handling 1,000,000 tons of coal and a practically unlimited amount of merchandise, and will have a water frontage of over one mile.

A FRENCH HOSPITAL FOR NEW YORK.—The Societie Francaise de Bienfaisance have purchased, it is stated, the property 320 and 322 West 34th street, and propose erecting a hospital of fifty beds. M J D Roedelsperger, at Cafe Delmonico, is said to be active in the state of the state

KANSAS CITY, MO.—Locust near 6th, 2 brdws; cost, \$12,500; 0, Emma Moulton.

Harrison cor 12th, br store; cost, \$9,000; 0, James Cotter.

21st and Kansas av, 5 br dws: cost, \$33,000; 0, Warren & Reddington.

rath and Oliver, 6 br stores; cost, \$30,000; o, S C Dollinger.

Harrison and 14th, 2 br dws; cost, \$18,000; o, W H Bartel. 8th cor Grove, 6 br dws; cost, \$30,000; o, J P Jack-

Norlidge pl, br and stone dw; cost, \$34,000; o, W C Scarritt. 65 buildings costing less than \$7,000.

SPRINGFIELD.—Cor Main and Elm st, brick bank bldg, 3 stories; o, Chicopee National Bank



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